Adrian Wallwork

ENGLISH

for Writing Research Papers

Springer

English for Writing Research Papers

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Preface

Who is this book for?

This book is aimed at researchers in any discipline who wish to write a research paper in English. If your first language is not English, you should find this book particularly useful.

I have never written a paper before. Will this book help me?

This book is intended both for inexperienced and experienced authors. In the Contents page, a (#) indicates that inexperienced writers should pay particular attention to this subsection. You can refer to the other points when you write more papers in the future.

The useful phrases in Chap. 19 will help you to structure your paper and give you an indication of the typical coverage of each section.

I have written many papers before. Will I still learn something from this book?

If you have ever had a paper rejected due to poor English, poor structure or poor readability, then this book will certainly help you.

What are the three most important things I will learn from this book?

This book is based on three fundamental guidelines.

I ALWAYS THINK ABOUT THE REFEREE AND THE READER

Your aim is to have your paper published. You will increase your chances of acceptance of your manuscript if referees and journal editors (i) find your paper easy to read, (ii) understand what gap you filled and how your findings differ from the

literature. You need to meet their expectations with regard to how your content is organized. This is achieved by writing clearly and concisely, and by carefully structuring not only each section, but also each paragraph and each sentence.

2 READ OTHER PAPERS, LEARN THE STANDARD PHRASES, USE THESE PAPERS AS A MODEL

You will improve your command of English considerably by reading lots of other papers in your field. You can underline or note down the typical phrases that they use to express the various language functions (e.g. outlining aims, reviewing the literature, highlighting their findings) that you too will need in your paper. You can also note down how they structure their paper and then use their paper as a template (i.e. a model) for your own.

3 WRITE CONCISELY WITH NO REDUNDANCY AND NO AMBIGUITY, AND YOU WILL MAKE LESS MISTAKES IN YOUR ENGLISH

The more you write, the more mistakes in English you will make. If you avoid redundant words and phrases you will significantly increase the readability of your paper.

What else will I learn?

You will learn how to:

- significantly improve your chances of having your paper published by thinking in terms of the referee and the reader
- reduce the number of mistakes you make in English
- plan and organize your paper, and structure each paragraph and each sentence so that the reader can easily follow the logical build-up towards various conclusions
- decide what to include in the various parts of the paper (Introduction, Methodology, Discussion etc.) and what typical phrases to use
- write a title and an abstract that will attract attention and be read
- highlight your claims and contribution
- make it 100% clear whether you are referring to your own work or someone else's
- use the minimum number of words required – this does not mean that less scientific content will be included, but simply that you find the clearest and most concise way to express this content
- increase the level of readability of your paper by helping readers to quickly understand what you are saying
- identify the correct style - personal or impersonal
- choose the correct tenses
- avoid ambiguity, for example being very careful that it is 100% clear what pronouns (e.g. it, them, this, these, one) refer to

Clearly, researchers from different disciplines write in different ways and sometimes follow a different structure. For example, there are significant differences between the

ways a medical, mathematical and sociological paper are written and constructed. However, whatever field you are in, the rules of good writing in English are the same: clarity, logic, conciseness (no redundancy), no ambiguity, and the highest level of readability possible.

This book focuses on language, structure and readability issues. It also tells you the key elements to include in the various sections of a paper.

It does not cover, for example, how to compile figures, tables, and bibliographies.

Who else will benefit from reading this book?

Proofreaders, those who work for editing services, referees, journal editors and EFL, ESL and EAP trainers should also find this book useful. I hope to be able to show you the reasons why the English of non-native speakers often does not comply with the standards of international journals. Knowing these reasons should then help you to give advice to authors on how to improve their manuscripts, and students on how to improve their writing in general. It should also help you understand the difficulties that non-natives have when writing in English.

Finally, if you are a tutor, supervisor or professor of any nationality, I hope that you will use this book as a resource to help your students improve their scientific writing skills. I imagine that you are generally able to identify the errors in writing made by your students, but you may not have the time or knowledge to explain how to rectify such mistakes.

I am a native English speaker. Should I read this book?

Most certainly. It contains good writing rules that are also found in books written exclusively for a native audience. Even papers written by native speakers are rejected in terms of poor readability i.e. the referee cannot understand what you are trying to say even though your English is grammatically correct. The only chapter that you probably don't need to read is Chap. 2, which deals with word order in English. Also, there are some grammatical rules that you can skip.

How is this book organized?

The book is divided into two parts and the full contents can be seen in the Contents on page xiii. This Contents page also acts as a mini summary of the entire book.

Part 1: Guidelines on how to improve your writing skills and level of readability.

Part 2: Guidelines about what to write in each section (Abstract, Introduction, Methodology etc.), what tenses to use, and typical useful phrases.

I recommend you read all of Part 1 before you start writing your paper. Then refer to specific chapters in Part 2 when you write the various sections of your paper.

Each chapter begins with a very quick summary of its importance. This is followed either by advice from experts in writing and/or science, or by typical comments made by referees in their reports. Many of the comments from the experts were commissioned specifically for this book. The other quotations are referenced in the Links and References section at the back of the book. The referees' comments are extracts from referees' reports, which I have edited to make them more concise and to avoid any technical words. The comments are designed to make you think of typical things referees might say about your work, and thus to warn you of potential pitfalls in your paper.

A typical chapter then proceeds with a series of points for you to take into account when you are carrying out a particular writing task.

Each chapter ends with a summary of the main points.

Chapter 20, the final chapter in the book, contains a checklist of things to check and to consider before sending your manuscript to the journal.

What about grammar?

Chapter 1 covers syntax, i.e. where to position different types of word (nouns, adverbs etc.) within a sentence. Chapter 6 discusses the most common grammatical mistakes that cause ambiguity and which could thus cause your paper to be rejected. Other essential grammar rules are covered in relation to when they are required in specific sections of a paper – see the Index on page 00. Further details on grammar are provided in the companion volume: English for Research: Usage, Style, and Grammar.

Are the extracts in this book taken from real papers?

Most of the examples are taken from real published papers, and in some cases the names of the authors and titles of the papers, plus where they can be downloaded, can be found in the Links and References section at the back of the book.

To explain some specific points, I have used original and revised versions of extracts from unpublished papers (i.e. from manuscripts being prepared by my PhD students) – again these are referenced at the back of the book. In a few other cases, I have invented examples.

How do I know if the examples given are good or bad examples?

Example sentences are preceded by an S, e.g. S1, S2. If they contain an asterisk (e.g. S1*) then they are examples of sentences that either contain incorrect English or are not recommended for some other reason. Longer examples are contained in a table. This table contains the original version (OV) and the revised version (RV). Unless otherwise specified, the OVs are all examples of how <u>not</u> to write.

Other books in this series

This book is a part of series of books to help non-native English-speaking researchers to communicate in English. The other titles are:

English for Presentations at International Conferences
English for Academic Correspondence and Socializing
English for Research: Usage, Style, and Grammar
English for Academic Research: Grammar Exercises
English for Academic Research: Vocabulary Exercises
English for Academic Research: Writing Exercises

Acronyms and Abbreviations

I have used and/or coined the following acronyms for use throughout this book.

KF: key finding (a very important result of your research)
KFP: key finding paragraph (a paragraph where a key finding is introduced and discussed)
NS: native speaker (someone whose first language is English)
NNS: non native speaker (someone whose first language is not English)
OV: original version
PV: paraphrased version
RV: revised version
S: sentence
S*: this sentence contains incorrect English

Note: Throughout the book I use X, Y and Z to replace the technical words used by the author of the example text.

Glossary

The definitions below are my definitions of how various terms are used in this book. They should not be considered as official definitions.

adjective: a word that describes a noun (e.g. *significant, usual*)
adverb: a word that describes a verb or appears before an adjective (e.g. *significantly, usually*)
ambiguity: words and phrases that could be interpreted in more than one way
active: use of a personal pronoun/subject before a verb, e.g. *we found that x = y* rather than *it was found that x = y*

direct object: in the sentence 'I have a book', the book is the direct object

indirect object: in the sentence 'I gave the book to Anna', book is the direct object, and Anna is the indirect object

infinitive: the root part of the verb (e.g. *to learn, to analyze*)
- ing form: the part of the verb that ends in – *ing* and that acts like a noun (e.g. *learning, analyzing*)

link word, linker: words and expressions that connect phrases and sentences together (e.g. *and, moreover, although, despite the fact that*)

manuscript: an unpublished written work that is going to be submitted for publication

modal verb: verbs such as: *can, may, might, could, would, should*

noun: words such as: *a/the paper, a/the result, a/the sample*

paragraph: a series of one or more sentences, the last of which ends with a paragraph symbol (¶)

passive: an impersonal way of using verbs, e.g. *it was found that x = y* rather than *we found that x = y*

phrase: a series of words that make up part of a sentence

redundancy: words and phrases that could be deleted because they add no value for the reader

section: a principal part of a paper e.g. the Introduction, Results, Discussion

sentence: a series of words ending with a period (.)

Use of initial capital letters

The various section headings used throughout a paper have been given an initial capital letter (Abstract, Introduction, Methodology etc.). An example:

In your discussion of the literature – here *discussion* is used in a general sentence, it could be replaced by a synonym, for instance, *analysis*

In your Discussion you need to – here *Discussion* refers to the Discussion section of the paper.

Tenses

The following tenses are referred to in this book.

FUTURE SIMPLE: *we will study, he will study* etc.
PRESENT SIMPLE: *we study, he studies* etc.
PRESENT CONTINUOUS: *we are studying, he is studying* etc.
PRESENT PERFECT: *we have studied, he has studied* etc.
PRESENT PERFECT CONTINUOUS: *we have been studying, he has been studying* etc.
PAST SIMPLE: *we studied, he studied* etc.

Punctuation

The following punctuation marks are referred to in this book.

.	full stop
,	comma
;	semi colon
( )	parentheses
‘blah’	single quotes
“blah”	double quotes

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Part I
Writing Skills

Chapter 1
Planning and Preparation

Why is this chapter important?

To write a well-structured paper in good clear English you need to have a method. If you don't have a good method you may waste a lot of time having to re-plan and re-write entire sections of your paper.

This chapter outlines some steps to follow and things to think about <u>before</u> you begin the writing process.

Reading this chapter should enable you to have clear preliminary ideas regarding:

- what journals are looking for (also in terms of English)
- standard phrases used in English in research
- how a typical paper is structured in your field
- what makes your research unique
- what referees' expectations may be

All these factors combined should then help you to communicate the results of your research in good clear English.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_1, © Springer Science+Business Media, LLC 2011

What the experts say

From note taking to publishing to teaching, language is the tool that gives sense to scientific activity. Whatever scientists do or observe, everything they come to know or to hypothesize, is mediated through language.

Robert Goldbort, Writing for Science

The writing of an accurate, understandable paper is just as important as the research itself.

Robert A Day, How to Write and Publish a Scientific Paper

Writing helps you to learn. Writing is not simply a task to be done once research or other preparation is completed - it can be an integral part of the work progress.

Nicholas Highman, Handbook of Writing for the Mathematical Sciences

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1.1 Think about why you want to publish your research

You will be more motivated to write a good paper, if you have thought about exactly why you want to have your research published. One of your reasons will probably be because you believe you can make a contribution to a gap in the current knowledge base of your field. It helps if you can write down concisely what this contribution is, and then double check that your proposed contribution really is original (see Sect. 1.6).

1.2 Give yourself enough time to plan and write your manuscript

You may have spent three years doing your research. Dedicating only three days or even three weeks to your manuscript makes little sense if it means that your paper will probably be initially rejected.

Allow at least twice as much time as you think it will take.

1.3 Choose an appropriate journal, preferably with a high impact factor

If you have never written a paper before and your supervisor has not indicated a specific journal where he/she would like you to publish, it is a good idea to ask colleagues in your research group what they read and what sort of publications they aspire to publish in.

Even if you are writing a paper for the first time, it does not mean that it will only be suitable for a marginal or not very well known journal. Your progress in academia very much depends on your ability to publish in journals that have a high impact factor.

An impact factor is a measure of how prestigious a journal is. The higher the impact factor, the more widely read the journal is, and the more likely other researchers will cite your paper. Tables of impact factors which rank all the peer-reviewed journals in the world are available on the Net, you can use Google Scholar to help you find them.

However, given the difficulties of getting published in a high impact journal (Sect. 20.14), you might consider opting for a short article or a 'letter'. A literature review or a methodological text is often publishable. For instance, if you are studying medicine, you could consider writing a clinical review - a 2,500 word

article which is essentially a review of the management of important and common problems. Many disciplines have such an equivalent.

When you have chosen three or four possible journals, look at their styles and think about their audience – what do the editors and readers expect from the articles (see Sect. 1.7)?

You could try to insert your paper into an ongoing discussion that is currently being covered in the journal. This approach may increase the chances of getting your paper approved by the editor.

The topic you choose to write about is obviously related to the journal where you want to publish. Occasionally it may be worth choosing the journal first (rather than your exact topic), and then deciding which angle of your research to focus on so that it will match the expectations of your chosen journal.

1.4 Download the instructions for authors from your chosen journal AND from a high impact journal in the same field

Each journal has its own requirements and style guide. These instructions tend to have different titles, for example: 'instructions for authors', 'notes for authors', 'author guidelines'. They often appear under a page called 'author resources'.

The guidelines include:

- types of titles that are acceptable
- structure of paper – for example, is the review of the literature near the beginning of the article or at the end? Are the Results included in the Discussion or in a separate section? Is there a Conclusions section?
- layout (including how the Abstract should be presented – one long paragraph, or 5–6 short paragraphs)
- structure of sections - some journals prescribe exactly how certain sections (most commonly the Discussion) are organized, and what subheadings should be included
- use of passive rather than personal style (*we*, *I*)
- how to make citations
- how to arrange the bibliography
- use of key words
- American or British spelling

It is vital that you rigorously follow your chosen journal's instructions to authors. So download these instructions from the journal's website before you start writing.

If you opt for a low impact journal, you will still find it very useful to look at the instructions of an equivalent high impact journal. Higher impact journals tend to have better author resources, which are useful for all authors, not just for those in the specific field of the journal itself.

If no journals in your discipline offer such resources, then I suggest that you look on the 'Welcome to resources for authors' page of the website of the British Medical Journal (bmj.com), one of the world's most prestigious journals. Even if you are not a medical researcher, the resources you will find there are very helpful.

The medical community has made a concerted effort to improve the quality of papers published in its journals. So reading one or two medical papers could help you learn techniques for clear structure and clear concise writing.

1.5 Read and analyze papers for your literature review, and note how they are structured

Once you have chosen your journal, look at the most frequently cited papers to see how the authors rationalize the various steps of their research. Try to use papers that you will probably quote in your section on the review of the literature, and which are highly relevant to your topic and/or classic papers in your general field.

For example, you could create a table with some or all of the following headings:

- problem that the research addresses
- background information and relevant references
- elements that validate the level of innovation of the research
- conceptual model, methodology or procedure that the research takes into consideration
- materials, equipment and software used
- method used and the operational steps that the author carried out
- results achieved
- analysis and interpretation of these results
- strengths and weaknesses of the research, the insights demonstrated
- implications for further research

Then you can fill in your table with brief notes for each of the papers you have analyzed. This analysis should help you to:

1. write your own literature review, because after this analysis you will be very familiar with the literature
2. identify the differences in other researchers' approaches and results compared to your research
3. note down the strengths and weaknesses (including possibly bias) in the work of others

These three points should enable you to understand in what ways your research is unique, innovative, interesting and useful, and how it extends what is already in the literature. Your aim is to find a knowledge gap to fill.

If you have done a very thorough literature search, then another publishing opportunity for you is to write a literature review.

1.6 Identify what the editor is looking for

Read as many papers as you can from your chosen journal. This should help you to gain a clearer picture of what the editors of the journal are looking for to enable them to keep their readership levels high. Below are some of the typical things that editors hope to find in manuscripts.

TYPE OF PAPER	Original research, or a systematic review, or a position paper etc. (for more on the various types of paper consult Google Scholar or Wikipedia)
SUBJECT	Hot topic (contemporary issues), original and innovative; or controversial; or classic
AIM	Clarity of purpose, i.e. the research objectives are clear
RESEARCH	Well conducted, methodology clear, ethical, reproducible, no bias, limitations admitted
RESULTS	In line with research objective; entirely new or confirmation of other results already published in the same journal; not too broad as to be meaningless; can be generalized outside your very specific field
LENGTH OF PAPER	Short or long
STYLE	Personal (*we*, *I*), or impersonal (exclusively passive form), or mix (personal and impersonal)

Sometimes journals have themed or special issues on specific topics. These special issues are announced many months in advance of publication. Keep a look out for an issue that covers your specific area - it may be the perfect opportunity for you.

1.7 Choose one paper as a model and note down useful phrases

Choose one paper that is close to your topic, that is written by a native English speaker, and that you enjoyed reading. Use this paper as a model into which you can 'paste' your own research.

Notice how your model paper is structured:

- how does the author begin?
- what points does s/he make in each section?
- how does s/he link paragraphs together?
- how does s/he connect the Results with the Discussion?
- how does s/he present the Conclusions?

As you read your model paper, note down some useful English phrases that the author uses. Such phrases will help to increase the readability of your text, as they will be familiar to your readers. for a list of useful phrases see Chap. 19, and see Sect. 10.2 for an extended example of what kinds of phrases you might like to note down yourself.

1.8 Think about the order in which to write the various sections

There is no standard order in which you should write the various sections of your paper. You should choose the order that suits you best. This may involve writing several sections simultaneously.

Many authors start with the Methods, which is often the easiest section to write because this is the part that will usually be clearest in your mind. Beginning with the Methods will also give you the confidence and impetus you need to move on to the other sections of the paper.

In reality, it is best to start with the Abstract as this will help you to focus / orient your ideas on what are the key aspects of your research. In any case, if you are going to present your work at a conference, the organizers will ask you to submit an abstract before you write the related paper - you can still change the Abstract when you have finished writing the actual paper.

You might find it useful to look at the scientific study protocol that you wrote when you outlined the aims of your research at the beginning of your PhD or before you began your current project. Here you should have written out your goals very clearly, and this will help you to write your Abstract.

The hardest part for most authors is the Discussion where you have to interpret your results and compare them with other authors' results. While you are writing the Discussion, you may find it useful to draft the Introduction, as some of the authors you mention will appear both in the Introduction and the Discussion.

A typical order for writing the various sections is thus:

Abstract (very rough draft)
Methods
Results
Discussion
Introduction
Conclusions
Abstract (final version)

It is a good idea to write the Results and Discussion before the Introduction. This is because you will only truly understand the significance of what you have done after you have written these two sections. Laying the background foundations on which you can highlight the significance of your research is a major part of the Introduction.

1.9 Create separate files for each section

If you decide to write several sections simultaneously, it helps to create files for each section. Then for each file write down a list of the key concepts you want to cover. You can write these down as notes in a random order. Often, as you are writing one section you will think of things that you need to put into other sections. Consequently, it may help to have all the files open so that you can quickly add to them whenever you need to.

Depending on the software you are using, you may have a References or Bibliography file that contains a list of papers, books and documents that you have cited before. So, if you are writing in LATEX for example, you can directly cite existing knowledge and previous findings and append any new references. Depending on your field of research, you may also have an appendix in which you have a code/program or some theorems with their proofs.

1.10 Chat with non experts

Some researchers find it hard to write the first words of a new paper. This is often because you don't have clear ideas in your head. So it may be useful simply to talk about your research with a friend or member of your family. To explain your research to such non experts really forces you to think about what is and is not important about your methodology and findings. After you have had this non-technical 'chat', you can write down some notes, which you can then insert into the relevant section files (Sect. 1.10).

Chatting with friends and family also gives you some idea about how hard or easy it is for non-experts to understand your subject. You can then think of ways to make your paper more accessible for people whose knowledge of your topic is less than yours.

1.11 Give mini presentations to colleagues

Before you begin writing, give an oral presentation of your methods and results to your colleagues. These colleagues can then give you useful comments and criticisms. They may be able to give you alternative interpretations, help you understand your anomalous findings, reassure you that it is OK to include your negative findings, and bring to your attention anything that you may have missed out. This will also help you to focus on highlighting your key findings. If you do your presentation in English, it may then help you to formulate phrases that you can then use in the paper.

1.12 Decide what your key findings are and whether you really have a contribution to make

One of my students once received the following comment by a referee as a justification for rejecting her paper: *Not acceptable. No new knowledge, science or discovery is presented.* This kind of comment may reach you even six months after you have sent your paper for review. For you, it represents a considerable waste in time and energy spent on a paper.

So, before you start writing you need to have an absolutely clear idea of:

- what your research goal was
- what your most important findings are and how you can demonstrate that they are true
- how these findings differ from, and add to, previous knowledge

You know implicitly what the importance of your findings are - after all, you may have been working for months and years on the project.

But the reader does not know.

You must give the reader a clear message.

Analyzing the literature (Sect. 1.5), and discussing and presenting your findings to colleagues (Sects. 1.10 and 1.11) should help you to identify what your key findings are.

Make a list of your key findings and choose the most important ones to fit the space you have available (i.e. the total word count allowed by your chosen journal). For each key finding decide if there is another possible explanation for what you have found. You can do this by looking in the literature again. Make sure you have not inserted any bias in your explanation of your findings. Next, write an explanation saying why you think each key finding is true. However, write your explanation in a way that shows you are open to other interpretations.

The above suggestions should also help you to decide whether your planned paper really will have a contribution to make.

1.13 For each section, think about how you can highlight your key findings

While you are planning what to put in each section, think of where and how you can highlight your contribution. It may help you to imagine that the reader has asked you these questions:

1. what problem are you trying to solve / investigate?
2. how did you solve / investigate it?
3. how does your solution / investigation differ from previous approaches?
4. what did you discover?
5. how do your findings differ from what is already in the literature, and what do they mean?

Readers generally read the Title and Abstract of a paper first, followed by the Discussion; though some may just look at your figures and tables! However, you cannot be sure at which section your readers will begin reading, so they need access to the answers to these questions in most or all the sections. Look at other papers in your chosen journal (Sect. 1.5) and at your model paper (Sect. 1.7) to see how the authors deal with such questions. Clearly, the emphasis you put on answering

the questions will vary from section to section, and is likely to be greatest in the Abstract and Discussion, but consider covering it in the other sections too.

When you revise your paper if you think you have done too much highlighting, then you can always remove a few sentences. But while drafting your paper if you constantly try to highlight your contribution, this will give you extra focus.

Think of your paper as a product that you are trying to sell to the referee and journal. The clearer and more convincing you are, the more likely a journal will 'buy' your manuscript.

For more on underlining your contribution see Chap. 8.

1.14 Always have the referees in mind

It is crucial to write your paper with the referees in mind. They are the ones that decide the fate (outcome) of your paper.

Referee 1 (R1): Top experts currently working in your field

These are the ones to whom most journal editors try to send manuscripts for review. They are the experts that know most about the topic and are therefore most suitable to carry out a peer review of your paper. They are also the ones who may have the least time and inclination to do such reviews, particularly as they may receive up to 10 requests per month for their services. Such referees tend to be most interested in whether the paper makes sense from a scientific point of view. They may be less concerned with language errors, provided such errors do not impede on their understanding your paper. They do not normally have time to make a detailed analysis of every sentence you write.

Referee 2 (R2): Retired experts

These referees are like R1s, but they have a lot more time on their hands, because they are no longer officially working. Because they have more time, they tend to enter into much greater detail, both from a scientific and language point of view.

Referee 3 (R3): PhD students

With the advent of so many online journals, more and more papers are being published every day. This means that top experts are in great demand. Rather than refusing an editor's request for them to do a review, they sometimes ask permission

to pass the paper on to one of their PhD students. This is often the case when reviews are requested for low impact / low ranked journals. Clearly, a PhD student's knowledge of your topic maybe less than your own, though this does not mean that they are unable to make a good evaluation of your work.

You need to keep all these types of referee happy!

1.15 Referees and English level

It is possible to write a paper in completely accurate English, but still have a paper rejected for poor writing skills - which is what happens even to native English researchers. On the other hand, a paper that is constructed well, and is easy to read, may be accepted (perhaps with some requests for minor revisions) even if the English is not totally accurate.

In my experience native referees tend to be more interested in how the paper flows and how easy it is to read. Non-native referees seem to focus more grammatical and vocabulary mistakes, so very accurate English is important in order to keep them satisfied too.

All referees will appreciate it if you use simple language. In a survey of students at Stanford University, 86.4% said they use complicated language when writing scientific papers just to make themselves sound more knowledgeable and intelligent. Referees, on the other hand, tend not to equate unnecessarily complex language with a high IQ.

There are no journals, as far as I know, that are easier to write for in terms of level of English required.

1.16 How to keep the referees happy

(1) Remember that a referee has no obligation to review your paper

Referees review manuscripts in their own time and have no direct financial reward for doing so. So do everything you can to make the referee's work easier and more pleasurable – clear English, clear layout, clear tables etc. By doing so you will increase the chances of your paper being accepted.

(2) Write in a way that a non-expert or less experienced person can understand

Research is becoming increasingly more specialized, so that even two people with the same degree may not be able to understand each other's papers.

Also, due to the fact that research groups cannot always get the funding they need for research in their specific field, they may have to shift their interests to a related field where funds are available. This entails them reading the literature from this new field. The clearer the literature is, the more they will understand.

This means that when you begin the writing process, you need to bear in mind that your reader may not be as expert as you are.

(3) Make your paper interesting enough for an expert

Try to ensure enough meat (i.e. scientific substance) for the experts. This does not mean you have to write in a more complicated way, but just that you include enough details get experts interested.

(4) Look at the forms used in referees' reports

Every journal has a standard form for use by referees when writing their reports, which the editor then uses to judge whether your paper is suitable for publication or not. Through your professor and colleagues, try to find as many such forms as you can, and preferably the one for your chosen journal.

You can use the questions in the forms as guidelines for your writing. Here are some examples:

- Is the research novel and of international relevance?
- Does the article fit the aims and scope of the journal?
- Is the paper written grammatically and clearly?
- Is the writing style succinct and appropriate to the work?
- Is the title appropriate to the content?
- Does the abstract accurately describe the content?
- Are the conclusions borne out by the evidence and arguments?

It will help you considerably if you think about all these questions while you are writing your paper. Also, when you have finished, you should check that the answer to each question is 'yes'.

1.17 Write directly in English and find ways to improve your writing skills

Write directly in English rather than in your native language. This may be hard at the beginning. But with a model paper written by a native English speaker in front of you, which you can follow step by step, it should be quicker than translating from your own language. From an English point of view, it should also be more

reliable and accurate because you will be using some standard phrases that you have lifted directly or adapted from your model English paper.

Some researchers find it much easier to write a paper if they have already written notes in English throughout the research project. This means that you will already have much of the content you need when you finally start writing your manuscript. It also means that you will get a lot of practice in writing in English and may help you to discover any gaps in your understanding of your topic.

It might also be worth finding a native speaker to correct your written English for you whenever you write notes during the research. This might be a useful alternative to following a general English language course as it will be much for focused and also tailored to your particular needs. However, if your department or institute offers writing courses these are obviously well worth attending.

With your colleagues you could set up a writing group within your academic department. This would enable you to practice your own English writing skills and evaluate those of others in a mutual learning process.

One way of improving your writing skills and raising your profile in your area of expertise is to consider writing letters. Journals generally publish letters that offer a short critical review of the research of others. Such letters tend to be about 300 words long, so the same as or a little longer than an abstract. You can also write online rapid responses to letters in print journals.

1.18 Consult online resources

This book contains advice for all types of papers. You can find more specific advice for your specific field by searching on the web. To do this you simply type in, for example, “how to write the discussion section” + “medicine” (i.e. your specific field) and this should provide you with useful articles.

In Part 2 of this book I have used comments and materials from various excellent websites, which highlight the top quality materials that are available on the web.

1.19 Summary

- Consult with your professor and colleagues about the most appropriate journal where you can publish your research
- Match your topic to the journal, or vice versa
- Download the guidelines for authors – these will tell you about the style and structure of your paper
- Choose frequently cited papers in the journal to see how other authors construct their argumentation, and note down ways in which your research is different and innovative with respect to theirs
- Choose one paper as a model onto which to map your research, imitating the style and organization. This model should be written by a native English speaker
- Note down useful / standard phrases from your model paper which you can then use in your own paper
- Decide on the best order to write the various sections of your paper. It is generally best to start with a very rough draft of the Abstract, and then whichever section is clearest in your head (generally the Materials and Methods)
- Consider having separate documents for each section. This enables you to work on several sections at the same time
- Make sure your unique contribution to your community is very clear in every section, not just in the Abstract
- Write in a way that even a non-expert can understand
- Referees work for free and often outside working hours – never submit a carelessly written manuscript
- Access referees report forms to understand the ways that referees will evaluate your work
- Write directly in English, and use every opportunity for improving your writing skills
- Use online resources

Chapter 2
Word Order

Why is this chapter important?

Just two or three badly constructed sentences may be enough for referees to initially recommend rejecting a paper and suggest having the English revised.

This chapter focuses on putting words in a sentence in the correct order. This correct order may be very different from the syntax of your own language.

A. Wallwork, *English for Writing Research Papers*,
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Typical complaints of Referees

There were several sentences that I was simply unable to parse. I failed to work out what the subject was and what verb related to it, nor could I identify what adjective or what adverb modified what noun or verb. At times it was like trying to decipher a doctor's handwriting. I am of the opinion that one should be able at least to identify the various components of a sentence and how they relate to each other, even if one does not understand the precise meaning of each component.

Although it is well-structured, it is extremely difficult to read because of the somewhat labored English.

I was often only able to understand the logic of the sentence when I read the last word. The authors need to rearrange the components of their sentence so that the reader immediately understands the build up of the logic.

2.1 Basic word order in English

English has a strict order in which words can appear in a sentence. S1 shows an example of this order.

S1. The researchers sent their manuscript to the journal.

This order is rarely altered. It is:

1. subject (*the researchers*)
2. verb (*sent*)
3. direct object (*their manuscript*)
4. indirect object (*the journal*)

The key is to keep the subject, verb, direct object and indirect object as close to each other as possible. This is illustrated in S2, which maintains the exact order of S1.

S2. Last week *the researchers sent their manuscript to the journal* for the second time.

S3. **The researchers* last week *sent* for the second time *to the journal their manuscript.*

S3 is incorrect English. The position of *last week* and *for the second time* is wrong, and the indirect object comes before the direct object.

2.2 Compare word order in your language with word order in English

Native English-speaking readers are accustomed to finding the various parts of speech (noun, verb, adjective etc.) in the order given in Sect. 2.1. If these parts come in a different order, this requires more effort by the native reader to understand the whole meaning.

Even very banal differences in word order can affect readers. *White and black*, for instance, sounds strange to a mother tongue English person, the correct order is *black and white*. It would also sound strange to someone who speaks, for instance Chinese, Hungarian, Polish or Tamil, as in this case they use the same order as in English. But it is likely to sound far more normal to a Hindi, Italian or Spanish speaker, where white comes before black.

You can improve the order in which you put words and information in an English sentence if you analyze how you do it in your own language and then analyze the differences with English. Here are two examples, with which your language may share some similarities.

> Germans don't like to begin sentences with the subject. For example, instead of "We have received your letter" they prefer "Your letter has reached us". German syntax dictates that the verb sometimes goes at the end of the clause or sentence, also making you wait for the main thrust of the sentence.

Russians have difficulties with constructing correct English sentences because unlike in English, there are no strict rules for word order. For example, in Russian a simple tongue twister that translates as "the mother was cleaning the window" would mean exactly the same thing if "mother" and "window" switch places. In English, it would of course make no sense.

2.3 Choose the most relevant subject and put it at the beginning of the sentence

Clear English requires that you put the subject at the beginning of the sentence, however you may have a choice of possible subjects.

X was elicited by Y.

Y elicited X.

In the simple example above, your choice will depend on whether you want to emphasize X or Y. The one you want to emphasize should be put as the subject.

As readers, we tend to focus on the areas of a sentence that come immediately before and after a full stop. This is because there is extra white space between one sentence and another, which acts as a restful pause for the eye. Our eyes are also drawn to the capital letter that begins each sentence. These are the moments where you potentially have the reader's attention, so don't waste them. If the first few words routinely contain no useful or new information, then it becomes very tedious. So the best solution is to shift 'no value added' phrases to later on in the sentence and preferably reduce them to one word. Otherwise you are encouraging readers to skim the whole time.

The sentences below (S1–S4) come from a paper written by a physicist in a physics journal. They all contain exactly the same information. However, there are four possible subjects:

S1. Particularly interesting for *researchers in physics* is the new feature, named X, for calculating velocity.

S2. *Physics* now has a new feature, named X, for calculating velocity.

S3. *Velocity* can now be calculated with a new feature, named X, which is particularly interesting for physicists.

S4. *X is a new feature* for calculating velocity. It is particularly interesting for physicists.

When deciding what the subject is for your sentence, it is generally best to choose the most recent or newest information. S1 and S2 refer to known situations - physics, and physicists - they do not give any new information, so they are not well constructed sentences.

S3 also begins with a known, in this case *velocity*. This is fine if velocity is the main focus. However, given that velocity is a common factor for physicists, then S4 may be the best solution as it begins with completely new information. The choice between S3 and S4 will depend on where the author wants to put the focus.

2.4 Choose the subject that leads to the most concise sentence

If your sentence is short and you have two possible subjects, which you could indifferently put at the beginning of the sentence, then choose the subject that will give the shortest sentence (S2 rather than S1).

S1. The *most significant values* are highlighted in *Table 1*.

S2. *Table 1* highlights the *most significant values*.

Shorter sentences are often obtained by using active (S2) rather than passive (S1) verbs.

2.5 Don't make the impersonal *it* the subject of the sentence

Putting *it* first often delays the subject. Use modal verbs (*might, need, should* etc.) where possible (Sect. 5.11).

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
It is probable that this is due to poor performance.	This *may / might / could* be due to poor performance.
It is possible do this with the new system.	This *can* be done with the new system.
It is mandatory to use the new version.	The new version *must* be used.

2.6 Don't use a pronoun (*it, they*) before you introduce the noun (i.e. the subject of the sentence) that the pronoun refers to

It is OK to use a pronoun at the beginning of the sentence, provided that this pronoun refers back to a noun in a previous sentence (i.e. a backward reference). For example:

S1. *Beeswax* is a very important substance because ... In fact, *it* is ...

In S1 it is clear that *it* refers to beeswax. But in S2 *it* refers to a noun that comes after (i.e. a forward reference). The reader does not know what the pronoun refers to and thus has to wait to find out.

S2. *Although *it* is a very stable and chemically inert material, studies have verified that the composition of *beeswax* is …

S3. Although *beeswax* is a very stable and chemically inert material, studies have verified that *its* composition is …

S3 immediately tells the reader what the subject is.

2.7 Put the subject before the verb

The subject in English must come before their verb. Here are some examples of simple mistakes (OVs) and their corrected versions (RVs). The subjects are highlighted in italics.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
In the survey participated *350 subjects*.	*Three hundred and fifty subjects* participated in the survey.
Were used *several different methods* in the experiments.	*Several different methods* were used in the experiments.
With these values are associated *a series of measurements*.	*A series of measurements* are associated with these values.

Say what something is before you begin to describe it. In the OVs below, the authors have delayed the subject (in italics) until the end of the clause. They have used an introductory subsidiary clause to stress the importance or evidence of the subject before telling the reader what the subject something is. This is not what is normally done in English, as indicated by the RVs.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Among the factors that influence the choice of parameters *are time and cost*.	*Time and cost are* among the factors that influence the choice of parameters.
Of particular interest *was the sugar transporter*, because ...	*The sugar transporter was* of particular interest, because ...
Important parameters *are conciseness and non-ambiguity*.	*Conciseness and non-ambiguity are* important parameters.

2.8 Keep the subject and verb as close as possible to each other

Word order in written English tends to reflect the way English is spoken. When native speakers talk they usually keep the subject and verb as close as possible. This is because the verb contains important information.

In S1 and S2, you force the reader to wait too long to find out what the verb is and thus delay important information.

S1. *A gradual decline in germinability and vigor of the resultant seedling, a higher sensitivity to stresses upon germination, and possibly a loss of the ability to germinate *are recorded* in the literature [5, 8, 19].

S2. *People with a high rate of intelligence, an unusual ability to resolve problems, a passion for computers, along with good communication skills *are generally employed* by such companies.

S3 and S4 are better solutions because they shift the verb to the beginning of the sentence and make the meaning / direction of the sentence immediately clear.

S3. There is generally a gradual decline in germinability and of the resultant seedling, followed by a higher sensitivity to stress upon germination, and possibly a loss of the ability to germinate [5, 8, 19].

S4. Such companies generally employ people with a high rate of ...

Both S3 and S4 use active verbs. But sometimes you may need to use the passive and you may have several subjects for the same verb. In such cases it is best locate the passive verb after the first subject (S5):

S5. People with a high rate of intelligence are generally employed by such companies. They must also have other skills including: an unusual ability to ...

2.9 Avoid inserting parenthetical information between the subject and the verb

If you insert more than a couple of words between the subject and the verb this will interrupt the reader's train of thought. In any case readers will consider this parenthetical information to be of less importance.

Sentences are much easier to read if they flow logically from step to step, without any deviations.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The result, after the calculation has been made, can be used to determine Y.	After the calculation has been made, the result can be used to determine Y.
This sampling method, when it is possible, is useful because it allows	When this sampling method is possible, it allows us ...
These steps, owing to the difficulties in measuring the weight, require some simplifications.	Owing to the difficulties in measuring the weight, these steps require some simplifications.
	These steps require some simplifications, owing to the difficulties in measuring the weight

The first RV highlights that it is best to put information in chronological order. The last RV shows that you can put the parts of a sentence in a different order depending on what you want to give the most emphasis to.

2.10 Don't separate the verb from its direct object

When a verb is followed by two possible objects, place the direct object (i.e. the thing given or received) before the indirect object (the thing it is given to or received by). This kind of construction is often found with verbs followed by 'to' and 'with': associate X with Y, apply X to Y, attribute X to Y, consign X to Y, give X to Y (or give Y X), introduce X to Y, send X to Y (or send Y X).

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
We can *separate*, with this tool, *P and Q*.	We can *separate P and Q* with this tool.
We can *associate* with these values *a high cost*.	We can *associate a high cost* with these values.

In S1 below, the direct object is very long and consists of a series of items, so the reader has to wait a long time before discovering what all these items are associated with. The solution, S2, is to put the indirect object after the first item and then use 'along with'. S3 and S4 are other alternatives to dealing with this problem.

S1. *We can *associate* a high cost, higher overheads, a significant increase in man-hours and several other problems *with these values*.

S2. We can *associate* a high cost *with these values*, *along with* higher overheads, a significant increase in man-hours and several other problems.

S3. We can *associate several factors with these values*: a high cost, higher overheads, a significant increase in man-hours and several other problems.

S4. The *following can be associated with these values*:

i. a high cost
ii. higher overheads
iii. a significant increase in man hours

2.11 Put the direct object before the indirect object

In the OVs below, the indirect object (in italics) has been placed at the beginning of the sentence or main clause. This is not the usual word order in English.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
However, only *for some cases* this operation is defined, these cases are called ...	However, this operation is only defined *for some cases*, which are called ...
Although *in the above references* one can find algorithms for this kind of processing, the execution of …	Although algorithms for this kind of processing are reported *in the above references*, the execution of…
This occurs when *in the original network* there is a dependent voltage.	This occurs when there is a dependent voltage *in the original network.*

2.12 How to choose where to locate an adverb

The rules regarding where to locate adverbs are not difficult to understand, but there are many of them. Here are some basic rules. For more detailed rules see the companion volume English for Research: Usage, Style, and Grammar.

MOST ONE-WORD ADVERBS, PARTICULARLY ADVERBS OF FREQUENCY

(a) Immediately before the main verb.

Dying neurons do not *usually* exhibit these biochemical changes.

The mental functions are slowed, and patients are *often* confused.

(b) Immediately before the second auxiliary when there are two auxiliaries.

Language would *never* have arisen as a set of bare arbitrary terms if …

Late complications may not *always* have been notified.

(c) After the present and past tenses of ‘to be’

The answer of the machine is *always* correct.

The adverbs *only* and *also*, which are two of the most frequently used adverbs in research papers, follow the above rules (a–c).

For special emphasis, some adverbs (*sometimes, occasionally, often, normally, usually*) can be placed at the beginning of a sentence,

Normally X is used to do Y, but *occasionally* it can be used to do Z

ADVERBS OF CERTAINTY

Adverbs of certainty (e.g. *probably, certainly definitely*) come immediately before the *negation* (*not* and contractions e.g. *don’t, won’t, hasn’t*)

These random substitutions will *probably* not have a major effect.

ADVERBS OF MANNER

An adverb of manner indicates how something is done. They are generally placed directly after the verb, or after the direct object

The curve rises *steadily* until it reaches a peak at 1.5.

This will help system administrators *considerably* to reboot the system.

Some adverbs of manner can go before the verb. But, since all adverbs of manner can always also go after the verb or noun it is best to put them there and then you will never make a mistake.

ADVERBS OF TIME

These go in various positions.

S1. Patients were treated *once a week*, and surgery was carried out *as soon as possible* after the decision to operate.

S2. * There has *recently* been an increasing interest in 3D cellular phones.

S3. **Recently* there has been an increasing interest in 3D cellular phones.

S4. **In the last few years* there has been an increasing interest in 3D cellular phones.

S2–S4 are very frequently found as the first sentence in an Abstract or an Introduction. Because of this frequency and because they delay the subject of the sentence (3D phones), such beginnings have a very low impact. They are better replaced with:

S5. 3D cellular phones have *recently* become the focus of considerable interest.

ADVERBS OF CONSEQUENCE AND ADDITION

Your aim is to try to put the subject at the beginning of the sentence. So if possible try to delay adverbs that indicate a consequence or add further support to a positive situation. Thus S1 and S2 below would normally be better rewritten as S3 and S4.

S1. **For this reason / It follows that / As a consequence / As a result*, it is not a good idea to use the old system.

S2. * The new system should be used. *In addition*, it should be integrated with all the data from the previous project.

S3. The old system should *thus / therefore / consequently* not be used.

S4. The new system should be used. It should *also* be integrated with all the data from the previous project.

If several sentences in sequence begin with a link word or phrase, this makes the paragraph very tedious for the reader.

ADVERBS OF CONTRAST AND OTHER LINK WORDS

Link words that indicate a contrast (e.g. *however, nevertheless, in contrast*) can be used at the beginning of the sentence. The information they give is crucial to the reader - they immediately tell the reader that there is going to be a change in direction of the logical flow of the paragraph. In contrast, link words that simply describe a consequence continue the flow rather than break it.

Other link words that are best placed at the beginning of a sentence are those that:

- enumerate points (*firstly, secondly, finally*)
- add further negative support to a negative concept (*moreover*)
- indicate a concession or begin an explanation (*since, although, despite the fact*)
- indicate an alternative (*alternatively*)
- attract attention or express some kind of emotion (*surprisingly, intriguingly, regrettably, unfortunately*)
- specify (*specifically, in particular*) - however in most cases these can simply be deleted

The words listed above are generally followed by a comma:

Firstly, the component is subjected to …

Interestingly, few works have examined …

Some link words tend to go in the middle of a sentence:

This tool costs $400, *whereas* that tool costs $300.

2.13 Put adjectives before the noun they describe, or use a relative clause

Adjectives normally go before the noun they describe. S1 is thus correct, but S2 is not a possible construction in English.

S1. This is an *interesting* paper.

S2. *This is a paper *particularly interesting* for PhD students.

If you want to put the adjective after the noun, you have to change the construction.

S3. This paper is *particularly interesting* for PhD students.

S4. This is a paper *that is particularly interesting* for PhD students.

S4 resolves the problem by inserting *that is* (which could also be replaced in non-restrictive cases by *which is*, see Sects. 6.1 and 6.2). Likewise, S5 below, is wrong because the description comes after the noun it refers to and no relative clause has been used.

S5. *We examined a patient, 30 years old, to investigate whether …

S6. We examined a patient, who was 30 years old, to investigate whether …

S7. We examined a 30-year-old patient to investigate whether …

S6, which uses a relative clause, is a possible replacement for S5, but S7 is the best solution. Note that in S7 the word *year* is in the singular. This is because *year* functions as an adjective that describes a noun (*patient*). Similarly, we say a *three-meter tube*, a *ten-kilometer journey*.

Note also the use of hyphens when nouns are used to modify other nouns. However, do not worry about this aspect, many native speakers also make mistakes with hyphens and referees are very unlikely to make comments if you make mistakes in this area.

2.14 Do not insert an adjective between two nouns or before the wrong noun

Generally, you cannot put an adjective between two nouns. Thus S1 and S2 should be rewritten as S3 and S4.

S1. * The editor *main* interface

S2. * The algorithm *computational* complexity

S3. The main interface of the editor
S4. The computational complexity of the algorithm

Do not put an adjective before a noun that it does not describe. S5 is not correct, S6 is.

S5. * The main document contribution
S6. The main contribution of the document

2.15 Avoid creating strings of nouns that describe other nouns

You cannot indiscriminately put nouns in front of each other. For example, you cannot say *art state technology* (state-of-the-art technology) or *mass destruction weapons* (weapons of mass destruction). But you can say *a software program* or *an aluminum tube*.

Native speakers do tend to string nouns together, but they intuitively know how to do it. In fact, they are not following any written rules, but they base themselves on examples that already exist. If you are a non-native speaker I strongly recommend that you verify on Google Scholar that your proposed string of nouns already exists and has been used by native English-speaking authors.

If it does not exist, it will sound very strange to any native English-speaking referees, and more than one occurrence of such structures could cause the referee to recommend that your English be revised.

If it has not been used by native English-speaking authors, then you need to change the order of the words, which normally entails inserting some prepositions. To learn how to do this, see Sect. 11.12.

2.16 Ensure there is no ambiguity in the order of the words

Ambiguity arises when a phrase can be interpreted in more than one way.

S1. *Professors like annoying students.
S2. *I spoke to the professor with a microphone.

In S1 it is not clear if 'annoying' describes the students, or it refers to what professors enjoy doing. Depending on the meaning, S1 could be disambiguated as in S3 or S4:

S3. Professors like to annoy their students.
S4. Professors like students who are annoying.

In S2 – did I use the microphone or was the professor holding it? Depending on the meaning, S2 could be disambiguated as in S5 or S6:

S5. Using a microphone, I spoke to the professor.
S6. I spoke to the professor who was holding a microphone.

S7 is another example where poor word order can create confusion:

S7. *To obtain red colors, insects and plant roots were used by indigenous people.

In S7 readers may initially think that *red colors* and *insects* are part of the same list. Readers will only understand that *insects and plant roots* is the subject of the verb when they get to the end of the sentence. To avoid this problem there are two possible solutions. S8 puts *insects and plant roots* as the main subject and S9 *primitive people*. The choices of S8 or S9 will probably depend on whether the primitive people have already been mentioned or not.

S8. Insect and plant roots were used to obtain red colors.

S9. To obtain red colors, primitive people used insects and plant roots.

We tend to read words in small groups. Often we think that if two or three words immediately follow each other they must be related in some way. S10 is initially confusing.

S10. The European Union (EU) adopted various measures to combat these phenomena. This resulted in smog and pollution levels reduction.

When we read *resulted in smog and pollution*, our initial interpretation is that the smog and pollution are the result of the EU's measures. Then when we move on and read *levels* we have to reprocess the information. This is not important if readers have to change their interpretation only once or twice in a paper. But if they have to do it many times, the cumulative effort required becomes too much. Some readers will stop trying to guess the meaning and stop reading. In your case, it may mean that your paper could be initially rejected. S11 is a much clearer version of S10.

S11. The European Union adopted various measures to combat this phenomena. This resulted in a reduction in smog and pollution [levels].

Another problem with word order is when you are comparing your methods and results with those of another author. In S12 below it is not 100% clear whether you are or are not in agreement with Walker's suggestion.

S12. We also demonstrated that x does not equal y as suggested by Walker (2011).

Does S12 mean that Walker suggested that x is equal to y and is thus in contrast to what you are saying (S13 and S14), or that he, like you, found that x does not equal y (S15).

S13. Unlike what was suggested by Walker (2011), we demonstrated that x does not equal y.

S14. Our findings do not concur with Walker (2011). In fact, we demonstrated that x does not equal y.

S15. In agreement with Walker (2011), we demonstrated that x does not equal y.

Ambiguity (Chap. 6) affects readability. If you force your reader to constantly interpret what you are writing, the reader will soon want to stop reading.

2.17 Summary

- Basic English word order is: (1) subject, (2) verb, (3) direct object, (4) indirect object. Keep these four elements in this order and as close to each other as possible.
- If you have a choice of subjects, choose the one that is the most relevant and leads to the shortest construction.
- Avoid delaying the subject. So don't begin a sentence with the impersonal *it*.
- Avoid inserting parenthetical information between the subject and the verb.
- Most adverbs are located just before the main verb, and before the second auxiliary verb when there are two auxiliaries.
- If possible, delay adverbs until later in the sentence. The main exceptions to this rule are adverbs of contrast and those that enumerate points.
- Put adjectives before the noun they describe, or use a relative clause. Do not insert an adjective between two nouns or before the wrong noun.
- Do not indiscriminately put nouns in a string.
- Avoid ambiguous word order.

Rules tend to have exceptions. The rules given in this section also have exceptions, and so you might find sentences written by native English speakers that contradict my rules.

Chapter 3
Breaking Up Long Sentences

Why is this chapter important?

In his book, *The Effective Communicator*, John Adair reports that approximately 90% of people understand an 8-word sentence on first reading, but only about 4% understand a 27-word sentence first time around, especially if it is poorly punctuated.

It is a good idea to write short clear sentences from the very beginning of your paper: you will lose more readers in the first 50 words than you will in the next 250.

Another reason for using short sentences is that we tend to read the beginnings and endings of sentences with more attention. This is because our eyes tend to be drawn to the white space between one sentence and another. The result is that if your sentence is long, the reader will focus less on the middle part of your sentence and may thus miss any important information contained in that middle part.

You are competing for space in the journal with many other authors. If your paper is immediately readable and the referees don't have to struggle to interpret it, there is a much greater chance that it will be accepted.

This chapter shows you high to create shorter sentences.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_3,

What the experts say

Your English instructor's joy at your ability to compose grammatically correct 200-word sentences must be disregarded as against your present goal of simplifying your reader's job.

Sam Katzoff, author of the NASA document "Clarity in Technical Reporting"

Only a few rambling sentences (often as long as a paragraph) would make a whole article sometimes incomprehensible, whereas a relatively large number of lexical 'errors' would have no effect on an otherwise well-written article.

Dr Robert Coates, author of "Language and publication in Cardiovascular Research articles", which analyses why papers are rejected

To be easy to digest, sentences must be reasonably short and not too complex. The reasons for this are not grammatical: they are connected with the number of items of information the reader can absorb in a single unit or 'thought'.

John Kirkman, writing expert, author of "Good Style - Writing for Science and Technology"

3.1 Think above all about the reader

Whether they are Nobel Prize winners, Oxford professors, or first-year university students, all readers prefer sentences that they:

- only need to read once
- don't have to read slowly because the sentence does not require intense concentration
- can process word by word and thus understand the build-up of the author's logic immediately, rather than only being able to reach their interpretation of the whole meaning at the end of the sentence

These goals are much easier to achieve if you write short sentences. The average length of a sentence in English has become shorter and shorter over the centuries. In Shakespeare's time it was about 45 words, 150 years ago, about 29 words, and today's experts recommended between 15 and 18 words. In the world of academic writing, I think you should aim for an upper limit of around 25 words.

3.2 The longer your sentence, the greater the chance it will be misunderstood

The referee of the paper where the following sentence appeared, asked the author to "delete this sentence or rewrite so that it means something sensible". 'Sensible' means something that makes sense. Note: I have changed the key words in this sentence to protect the author, but the structure is identical.

> Even if the occurrence of this particular form of pulmonary tumor occurs on a rare basis, since the behavior of these tumors is extremely difficult to predict and the histological features resembling a discrete cell tumor may lead to misdiagnose a C2 tumor as a C1 tumor, it would be of interest to characterize those lesions and to take them into account in the differential diagnosis of hereditary or congenital tumors.

The referee's criticism was very serious. He/She recommended that the sentence be deleted because in his/her opinion it seemed to make no sense. It made no sense because it was one long sentence containing a lot of very different ideas. The problem is that referees do not usually have the time to decipher your sentences and work out the connections between the ideas contained therein. If they do not understand immediately, then this is likely to aggravate them.

The author then rewrote the sentence as follows.

> This particular form of pulmonary tumor appears to be extremely rare. Its behavior is extremely difficult to predict. Moreover, the histological features, which resemble a discrete cell tumor, may mean that a C2 tumor is misdiagnosed as a C1 tumor. It would thus be interesting to characterize these lesions and to take them into account in the differential diagnosis of hereditary or congenital tumors.

By breaking up one long sentence into four shorter sentences, the author managed to explain his concepts more clearly. His original sentence contained 71 words. The rewritten version contains four sentences of 11, 7, 22 and 24 words, making a total of 64 words, so less words than the original sentence.

His paper contained one other such sentence - the referee's comment in this case was: "Cut this sentence - it is meaningless as it stands". These two sentences, plus a series of other minor changes to the English, were enough for the referee to recommend an initial rejection of the paper. The cost to the author was a delay of three months to publication. In the meantime another author could have published (but fortunately didn't!) a similar paper and thus deprive him of his 'scoop' (i.e. being the first person to report some new information).

Below are two other examples from other papers. Note how the RVs bring out the meaning much more clearly, by splitting the sentence up into different units of thought.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Since several organic pollutants, such as PCBs, can bioaccumulate within the trophic web, *at a level* directly related to environmental levels, and levels within an organism's diet, *for an accurate* risk assessment, all the information on congener levels in the biota and environment were integrated with ...	*It is known that* several organic pollutants, such as PCBs, can bioaccumulate within the trophic web. *This takes place at a level* directly related to environmental levels, and levels within an organism's diet. *Therefore to get an accurate* risk assessment, all the information on congener levels in the biota and the environment were integrated with ...
Thus for a correct evaluation of environmental risk, the analytical effort has to take a holistic approach, *in other words the bio-monitoring* and the chemical measurements have to be integrated, taking into account the diversity and similarities between organisms and between them and their environment, *to have as a complete a vision* as possible of all the possible transport routes, and ...	To assess environmental risks correctly, analyses thus need to take a holistic approach. *Bio-monitoring* and chemical measurements need to be integrated, taking into account any diversity amongst organisms and between organisms and their environment. *This would contribute towards a complete vision* of all the possible transport routes, and ....

3.3 Short sentences are not a sign of inelegance and superficiality

Some non-native researchers feel inadequate because they are unable to express themselves in the same way as they would in their own language. This is particular true for researchers in the humanities and social sciences, where authors often

express opinions rather than solely hard facts. Before I hold writing courses with PhD students, I give them a questionnaire. One question is: 'What for you is the most difficult aspect of writing in English?' One student, Sara Tagliagamba, wrote:

> In Art History, we tend to construct periods with long sentences, which are absolutely necessary to give descriptions, attributions and reasons. It's hard to translate an article into English, choosing the right words and using simple constructions. So sometimes I lose some shades of meaning. In the end, in fact, I think that my abstracts work better in Italian than in English.

Inevitably some shades of meaning will be lost, but the key point is that research papers are designed to communicate findings amongst the community – they are not literary works. In any case not all members of the community have the same level of English, so such shades of meanings might still be lost.

More importantly, long sentences are NOT 'absolutely necessary'. For example, the Viennese art historian, Ernst Gombrich wrote many of his books in English rather than in his native German. His *Story of Art*, first published in 1950, is one of the most widely accessible art history books ever published, precisely because it is written in a clear, simple, unpretentious style. It is a myth that complex ideas can only be expressed in complex sentences.

Four years later I contacted Sara to check whether I could use her quote about art history in this book. She wrote back saying:

> Since your course I have been commissioned to write seven books in English on art history! What I now realize is that at the beginning I felt that my English was less elegant than my native Italian. In Italian I tend to use many adjectives that fit perfectly with a description of some sculpture or painting. Now when I write directly in English my meaning becomes much clearer. English acts as a kind of filter. It makes me focus on what is really important (what I have discovered) and helps me filter out the rest (typically, long series of beautiful poetic descriptions!). I am now convinced that writing in simpler way will certainly not affect a researcher's chances of having her papers published. It may even improve them!

3.4 Why and how long sentences are created

Long sentences contain one or more of the following:

1. a link word or phrase (e.g. *and, moreover, in fact, although, due to the fact that*).
2. a list of items, most of which are qualified (i.e. by enumerating their characteristics). This is typical when authors describe a procedure that has many parts or some equipment / software that has many components.
3. one or more semicolon or colon, or a lot of commas. This is typical of an author who does not want to waste time organizing his/her thoughts in a way that will be clearer to the reader.

Link words and punctuation are used either add to or qualify the preceding part of the sentence, or to introduce a new idea. The resulting sentence in all three cases is often too long to be understood easily on a first reading.

Long sentences are caused by adding on too many parts to the main clause. First we need to decide what constitutes a long and complex sentence.

S1. We did several surveys, which all gave the same result.

S1 is ten words long. It is easy to read even though it has two parts (separated by the comma).

However, if we expand it too much it becomes more difficult to read:

S2. * We did several surveys aimed at investigating whether stress increases in proportion to the number of children a couple has *and* each survey led to the same result, i.e. that there is no correlation, *thus confirming* the hypothesis that stress in the family is generally connected to factors other than size.

S2 is 51 words long. It is still possible to understand on a first reading but it requires more effort on the part of the reader. Because it is so long, the reader cannot be sure which are the most important elements in it. The reader could assimilate and judge the weight of the information if the sentence were divided up into three parts.

S3. We did several surveys aimed at investigating whether stress increases in proportion to the number of children a couple has. Each survey led to the same result, i.e. that there is no correlation. This confirmed the hypothesis that stress in the family is generally connected to factors other than size.

In S3 the reader can easily and immediately understand the information because it is now presented in three shorter blocks. Basically, you should be able to read a sentence in one breath - try reading S2 aloud without stopping to breathe. It is not easy.

In S2 the words in italics (*and, thus confirming*) identify where the sentence could be stopped because they are used to add additional information.

So a good general rule is that if the first part of a sentence is more than 12–15 words long, don't add a second part that is more than 10–12 words.

The rest of this chapter examines how to divide up longer sentences into shorter sentences.

3.5 *and*

In the OV below, *and* is used in two different ways:

(1) to join two verbs (*speak and write*) and two nouns (*English and Italian*)

(2) to add additional information (*and that this is true .. and to this end*)

In the first case there is no problem, but the second usage makes the sentence too long (65 words). The revised version rearranges the order in which the information is given, and divides the sentence into three parts.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The aim of this paper is to confirm that how we speak *and* write generally reflects the way we think *and* that this is true not only at a personal but also at a national level, *and* to this end two European languages were analyzed, English *and* Italian, to verify whether the structure of the language is reflected in the lifestyle of the respective nations.	How we speak and write generally reflects the way we think and act**.** *This* paper aims to prove that this thesis is true not only at a personal but also at a national level. *Two* European languages were analyzed, English and Italian, to verify whether the structure of the language is reflected in the lifestyle of the respective nations.

The OV below contains three ideas that are linked together using *and*, thus creating one long sentence.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The treatments are very often expensive and technically difficult, *and* their effectiveness very much depends on the chemical and physical characteristics of the substances used for impregnation, *and* on their ability to …	The treatments are very often expensive and technically difficult. *Their* effectiveness very much depends on the chemical and physical characteristics of the substances used for impregnation. *Also important* is their ability to …

The RV replaces the first *and* with a full stop - which is generally the simplest way to reduce the length of a sentence. The second occurrence of *and* cannot simply be replaced by a full stop. Instead, the writer uses *also* to alert the reader of additional details and then uses *important* to recall the concept of effectiveness.

Sentences containing multiple uses of *and* are often found in the materials and methods sections of a paper. It is much easier for readers to understand what materials you used and what procedures you followed if you divide your descriptions into short sentences. Each sentence should only cover one or two items or steps – however see Sect. 15.4 for cases where this is not applicable.

S1. *All samples were collected at the same time (9 AM) every day to prevent any effects of possible circadian variation *and* then stored after treatment at 4°C until assay.

S2. All samples were collected at the same time (9 AM) every day to prevent any effects of possible circadian variation. *They* were then stored after treatment at 4°C until assay.

In S1 readers initially think that the *and* clause is going to introduce a second prevention. Readers then have to revise their perception when they realize that *and*

actually introduces the next step. S2 resolves this initial ambiguity by beginning a new sentence to highlight that the author is now talking about a different step. Here are two more examples that illustrate the same point.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Seeds, sterilized for 3 min in NaOCl (1% available chlorine) *and* rinsed with distilled water, were germinated on moist filter paper (Whatman No. 2) in Petri dishes *and* grown in the dark at 23°C.	The seeds were sterilized for 3 min in NaOCl (1% available *chlorine), and* rinsed with distilled water. *They* were then germinated on moist filter paper (Whatman No. 2) in Petri dishes and grown in the dark at 23°C.
At the beginning we performed 2D and 3D forward modeling of a medium where only the lithological discontinuities were taken into account *and* compared the apparent synthetic resistivity *and* phase curves with our experimental data.	At the beginning we performed 2D and 3D forward modeling of a medium where only the lithological discontinuities were taken into account. *We* then compared the apparent synthetic resistivity and phase curves with our experimental data.

3.6 *as well as*

as well as is used to add some additional information. It is often used as an alternative to *and* when the sentence might otherwise contain too many *ands* and would thus confuse the reader. If using *as well as* will create a very long sentence, it is best to break the sentence. However you cannot begin the new sentence with *as well as*. Instead you have to repeat some part of the previous sentence, as in the two RVs below

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
This finding could be explained by the specific properties of gold, silver and platinum *as well as* by the conditions in which these metals were found, for example silver was found in ...	(1) This finding could be *explained* by the specific properties of gold, silver and platinum. *Another explanation could be* the conditions ... (2) ... silver and platinum. *The conditions* in which these metals were found could *also* be an *explanation*. For example, ...

3.7 Other link words that introduce additional information: *moreover, in addition, furthermore*

The techniques used for dealing with *and* (Sect. 3.5) can also be used for sentences containing words and phrases that have a similar meaning to *and* such as *in addition, furthermore,* and *moreover*.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The treatments are very often expensive and technically difficult, moreover their effectiveness very much depends on ...	The treatments are very often expensive and technically difficult. Moreover, their effectiveness very much depends on ...

3.8 Link words that compare and contrast: *whereas, on the other hand; although, however*

You cannot always break up a long sentence that contains a link by beginning a new sentence using that link word. This is because not all link words can be used at the beginning of a sentence. For example, when *whereas* is used to compare two findings in one long sentence, it should be replaced with *on the other hand* when the sentence is split into two.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The levels of cadmium in Site C were comparable to the levels found in Sites A and B in the previous years, *whereas / on the other hand* the levels for copper were much lower in Site C with respect to the values found in the previous sampling campaigns in 2008 and 2010.	The levels of cadmium in Site C were comparable to the levels found in Sites A and B in the previous years. *On the other hand*, the levels for copper were much lower in Site C with respect to the values found in the previous sampling campaigns in 2008 and 2010.

The use of *although* and *however* is the same as with *whereas* and *on the other hand*, respectively.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The levels of cadmium in Site C were comparable to the levels found in Sites A and B in the previous years, *although / however* this was not the case for the levels found in the south-east part of Site C.	The levels of cadmium in Site C were comparable to the levels found in Sites A and B in the previous years. *However*, this was not the case for the levels found in the south-east part of Site C.

Although can only be used in a two-part sentence, where one part depends on the other. For example:

> *Although this book* was written for non-native speakers, *it can also* be used by native speakers.

In the RV above, *although* would not be possible because there is no dependent clause.

Some link words are used to give explanations in the middle of a sentence such as *because, since, as*. If you split the sentence, you cannot begin immediately with the same link word.

3.9 Link words that give explanations: *because, since, as, in fact*

Words such as *since* and *although* are often used in a subordinate clause at the beginning of a sentence, as in S1 below.

S1. **Since* English is now spoken by 1.1 billion people around the world and is used as a lingua franca in many international business and tourism scenarios between people of different languages and between native English speakers and non-native speakers, *the learning of foreign languages in the United Kingdom has suffered a huge decline*.

The problem with S1 is that readers are forced to carry an idea in their head before they understand how this idea relates to the idea in the main clause (in italics). It would be much easier for readers to understand if S1 was split into two parts and rewritten as in S2.

S1. English is now spoken by 1.1 billion people around the world and is used as a lingua franca in many international business and tourism scenarios between people of different languages and between native English speakers and non-native speakers. The consequence is that the learning of foreign languages in the United Kingdom has suffered a huge decline.

Like *although* (see Sect. 3.8) the link words *since* and *as* require a dependent clause. For example:

Since / As you are a PhD student, *you* probably have to write a lot of papers in English.

This means that *since* and *as* could not be used in the RV below.

ORIGINAL	REVISED
The chemical characterization of organic paint materials in works of art is of great interest in terms of conservation, *because / since / as* the organic components of the paint layer are particularly subject to degradation.	The chemical characterization of organic paint materials in works of art is of great interest in terms of conservation. *This is because / In fact* the organic components of the paint layer are ...

3.10 Link words that express consequences: *owing to, due to, as a result of, consequently, thus* etc.

These link words are used to explain the reasons for 'something' that has just been mentioned (S1) or is about to be mentioned (S2). The 'something' to be done in the examples below is to simplify a procedure.

S1. *It was found necessary to make some simplifications to our procedures (essentially we did A, B and C), due to the difficulties in measuring the weight of the various compounds, particularly with regard to the weights of X, Y and Z.

S2. *Owing to the difficulties in measuring the weight of the various compounds, particularly with regard to the weights of X, Y and Z, it was found necessary to make some simplifications to our procedures, essentially by doing A, B and C.

In such cases, it might be clearer for the reader if you split the sentence into three (S3).

S3. We encountered difficulties in measuring the weight of the various compounds, particularly the weights of X, Y and Z. We thus decided to make some simplifications to our procedures. This entailed doing A, B and C.

3.11 *which* and relative clauses

which is used to add information. For example:

S1. English is now the world's international language, *which* is why it is used in scientific papers.

S2. English, *which* has now become the world's international language, is studied by more than a billion people.

S3. English, *[which is] now spoken* by more than a billion people, is the world's international language.

In S1 *which* is used to introduce an additional piece of information (in this case an explanation). In S2 *which* gives some extra information about the subject of the sentence (the English language). In S3, *which* serves the same purpose as in S2, it is in brackets because it could be cut.

In all three cases, the meaning is quick and easy to understand because the sentences are quite short.

Problems arise when sentences are longer, as highlighted in the OV below.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
English is now the world's international language and is studied by more than a billion people in various parts of the world thus giving rise to an industry of English language textbooks and teachers, *which* explains why in so many schools and universities in countries where English is not the mother tongue it is taught as the first foreign language in preference to, *for example*, Spanish or Chinese, *which* are two languages that have more native speakers than English.	English is now the world's international language and is studied by more than a billion people in various parts of the world thus giving rise to an industry of English language textbooks and teachers. *This* explains why in so many schools and universities in countries where English is not the mother tongue it is taught as the first foreign language. *For example,* English is taught in preference to Spanish or Chinese, *which* are two languages that have more native speakers than English.

In the OV the introduction of two new pieces of information using *which* makes the sentence unnecessarily long (79 words). In the RV, the first occurrence of *which* is replaced by *this*, which stands for *this fact*. Using *this* either alone or associated with a noun (e.g. *this fact, this decision, this method*) is a very common and useful way to reduce the length of a sentence.

The OV below contains an example of the use of *which* as in S2.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
English, *which* has now become the world's international language and is studied by more than a billion people in various parts of the world thus giving rise to an industry of English language textbooks and teachers, is generally used in scientific papers.	(1) English is generally used in scientific papers. In fact, English has now become the world's international language and is studied by more than a billion people in various parts of the world. This has given rise to an industry of English language textbooks and teachers. (2) English has now become the world's international language and is studied by more than a billion people in various parts of the world. This has given rise to an industry of English language textbooks and teachers. Today, English is generally used in scientific papers.

In the OV, the subject (*English*) and the main verb (*is*) are separated by 35 words. This means that by the time readers reach the main verb, they may have forgotten what the subject is.

There are two ways to resolve this problem. In the first RV, the author has decided to make scientific papers the key topic, so now this appears at the beginning of the sentence rather than at the end. In the second RV, the author first gives some information about English and then talks about scientific papers. The choice of using the first or the second technique, will depend on the emphasis you want to give to each piece of information.

The OV below contains an example of the usage given in S3. Even in short sentences, this kind of usage is dangerous as you may not know whether you can or cannot omit *which*.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
English, [which is] *now spoken* by more than a billion people from all over the world, the biggest populations being those in China and India, and more recently in some ex British colonies in Africa, is the world's international language.	English is the world's international language. It is *now spoken* by more than a billion people from all over the world. The biggest populations are those in China and India, and more recently in some ex British colonies in Africa.

The OVs below show two other examples where *which* has been omitted. Note how the words *area* and *distinction* are repeated. This repetition is not considered bad style in English scientific writing.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Using the method described by Peters et al. (2010), we assessed the state of pollution of three sites in a coastal area [which was] *characterized* by high levels of agricultural, industrial and tourist activity, as well as occasional volcanic activity (the last major eruption was in 1997).	Using the method described by Peters et al. (2010), we assessed the state of pollution of three sites in a coastal area. *This* area *is characterized* by high levels of agricultural, industrial and tourist activity, as well as occasional volcanic activity (the last major eruption was in 1997).
Using the approach described by Smith and Jones (2011), a *distinction*, [which was] *useful* for analysis purposes, particularly in the final stages of the project, was made between the three types pollution: agriculture, industry and tourism.	Using the approach described by Smith and Jones (2011), a *distinction*, was made between the three types of pollution: agriculture, industry and tourism. *This distinction* was useful for analysis purposes, particularly in the final stages of the project.

3.12 - *ing* form

Another way writers typically link phrases together is to use the - *ing* form a verb. If using the - *ing* form will significantly add to the length of a sentence, you can use another form of the verb and begin a new sentence.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Using automatic translation software (e.g. Google Translate, Babelfish, and Systran) can considerably ease the work of researchers when they need to translate documents *thus saving* them money (for example the fee they might have otherwise had to pay to a professional translator) and *increasing* the amount of time they have to spend in the laboratory rather than at the PC.	Using automatic translation software (e.g. Google Translate, Babelfish, and Systran) can considerably ease the work of researchers when they need to translate documents. *Such software saves* them money, for example the fee they might have otherwise had to pay to a professional translator. It *also increases* the amount of time they have to spend in the laboratory rather than at the PC.

The RV above shows two ways to deal with the - *ing* form. First, you can repeat the subject (*software*) and then change the -ing form into the present tense (*saves, increases* rather than *saving, increasing*), or whatever tense is appropriate.

In the OV below, the - *ing* form is used instead of a relative clause: the author could have written *which indicates*. In such cases, you can break the sentence immediately before the - *ing* form and then start a new sentence with *This*.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
As can be seen from Table 1, the concentrations were far higher than expected especially in the first set of samples, *indicating* that one cause of pollution was ...	As can be seen from Table 1, the concentrations were far higher than expected especially in the first set of samples. *This indicates* that one cause of pollution was ...

3.13 *in order to*

Often you need to explain the rationale for adopting a particular procedure or line of research. To do this, writers typically use expressions such as *in order to, with the purpose of, with the aim to, in an attempt to*

This is fine if you can express the rationale in a few words, as in this example:

In order to test our hypothesis, we sampled a random selection of documents.

But if your rationale is longer than about 15 words, you probably need to split the sentence up, as shown below:

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Our readability index is based on a series of factors - length of sentences and paragraphs, use of headings, amount of white space, use of formatting (bold, italics, font size etc.) - in order to provide writers with some metrics for judging how much readers are likely to understand the writers' documents.	*We wanted to provide* writers with some metrics for judging how much readers are likely to understand the writers' documents. *We thus produced a readability index* based on a series of factors - length of sentences and paragraphs, use of headings, amount of white space, and use of formatting (bold, italics, font size etc.).
In order to establish a relationship between document length and level of bureaucracy and to confirm whether documents, such as reports regarding legislative and administrative issues, vary substantially in length from one language to another, *we conducted an analysis of A, B and C.*	(1) *We conducted* an analysis of A, B and C. *The aim of the analysis was to* establish .... (2) *We wanted to establish* a relationship between .. language to another. *To do this*, we conducted ...

The two techniques shown in the RV are

- either say what you did and then why you did it
- or give your rationale and then say what you did

The first is generally more helpful for the reader because it helps to put the rationale in context.

3.14 Excessive numbers of commas

When commas are used in lists, they are fine:

> Many European countries are now part of the European union, these include France, German, Italy, Portugal, Spain, ...

However, when commas are used to separate various clauses within a sentence, readers have to constantly adjust their thinking. Also, the more commas there are in a sentence, the longer the sentence is likely to be.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
As a preliminary study, in an attempt to establish a relationship between document length and level of bureaucracy, we analyzed the length of 50 European Union documents, written in seven of the official languages of the EU, to confirm whether documents, such as reports regarding legislative and administrative issues, vary substantially in length from one language to another, and whether this could be related, in some way, to the length of time typically needed to carry out daily administrative tasks in those countries (e.g. withdrawing money from a bank account, setting up bill payments with utility providers, understanding the clauses of an insurance contract). The results showed that ...	Our aim was to see if there is a direct relationship between the length of documents produced in a country, and the length it takes to do simple bureaucratic tasks in that country. Our hypothesis was: the longer document, the greater the level of bureaucracy. In our preliminary study we analyzed translations from English into seven of the official languages of the European Union. We chose 50 documents, mostly regarding legislative and administrative issues. We then looked at the length of time typically needed to carry out daily administrative tasks in those countries. The tasks we selected were withdrawing money from a bank account, setting up bill payments with utility providers, and understanding the clauses of an insurance contract. The results showed that ...

The OV demonstrates that the excessive use of commas is a sign of lazy writing. The writer simply begins a sentence and keeps adding details to it, without thinking about how the reader will assimilate all these details. It also indicates that the writer is probably not clear in his / her own mind about what he / she wants to say.

Note that the RV:

- uses more words in total, but is considerably easier to follow
- rearranges the various subordinate clauses and puts them into a more logical order and in separate sentences
- divides up the information into paragraphs - the first explains the rationale, the second shows how the investigation was carried out. This makes the connection between ideas much clearer

Commas can also be dangerous if you use them to build up a series of phrases each of which describes the previous one, as in S1.

S1. In particular, the base peak is characteristic of the fragmentation of dehydroabietic acid, the main degradation marker formed by aromatization of abietadienic acids, the major constituents of pine resins.

Initially when reading S1 it seems that the *peak* is a *characteristic* of a series of items separated by commas. Then as we read further we understand that *the main degradation marker* is not in fact a second element in a series of items. Given that *the main degradation marker* comes immediately after *dehydroabietic acid* we assume that this acid must be a *marker*. We then realize that in fact it refers back to *fragmentation*. S1 thus requires much interpretative effort by the reader and is better rewritten as in S2:

S2. The base peak is characteristic of the fragmentation of dehydroabietic acid. *This fragmentation* is the main degradation marker formed by aromatization of abietadienic acids, *which are* the major constituents of pine resins.

S2 divides S1 into two separate sentences and also clarifies the relationships between the various elements.

3.15 Semicolons

Semicolons (;) are not commonly used in modern English. If you tend to use a semicolon before introducing an additional idea or additional information, think about using a period (.) instead.

By 1066 English, or Old English as it is known, was firmly *established; it* was a logical language and was also reasonably phonetic. This situation changed dramatically when England was invaded by the Normans in *1066; in* fact, for the next 250 years French became the official language, and when English did come to be written again it was a terrible concoction of Anglo-Saxon, Latin and French.

The author of the above extract used semicolons to show that the two parts of the sentence to some extent depend on each other. Although this usage could be considered correct, today it is considered as unnecessary. Thus the two semicolons could easily be replaced by full stops, with no change of meaning for the reader.

When we read we automatically pause for an instant when we reach a full stop. This is our mental equivalent to pausing and inhaling air when we are speaking. Semicolons don’t allow for such a pause and thus make the reading process slightly more tiring. Semicolons also make the sentence look longer, which makes them more tiring on our eyes.

Some writers also use a colon (:) in the same way as a semicolon. Again, if your sentence is going to be very long as a result of using a colon, it is better to replace the colon with a full stop and begin a new sentence.

S1. Old English had two distinct advantages over Modern English: it had a regular spelling system and was phonetic.

S2. Old English, which is the language spoken in most parts of England over 1,000 years, was a relatively pure language (the influence of Latin had not been particularly strong at this point, and the French influence as a result of the Norman Conquest was yet to be felt) and had two distinct advantages over Modern English: it had a regular spelling system and the majority of words were completely phonetic.

S3. Old English was the language spoken in most parts of England over 1,000 years. It was a relatively pure language since the influence of Latin had not been particularly strong at this point, and the French influence as a result of the Norman Conquest was yet to be felt. It had two distinct advantages over Modern English: it had a regular spelling system and the majority of words were completely phonetic.

In S1 the use of the colon (:) is fine, because the whole length of the resulting sentence is less than 20 words. But S2 is already too long even without the subsidiary clause introduced by the colon. S2 would in fact be better divided up into three parts as in S3.

3.16 Semicolons in lists

The only time you really need to use semicolons is to divide up short lists to show how each element in the list relates to each other. Note how S2 is clearer than S1 through the helpful use of semicolons.

S1. *The partners in the various projects are A, B and C, P and Q, X and Y and Z.

S2. The partners in the various projects are A, B and C; P and Q; X; and Y and Z.

S2 shows more clearly that there are four groups of partners: (1) A, B, C; (2) P, Q; (3) X; (4) Y, Z.

But if your list is long, as in the OV below, it is better to divide it up into shorter sentences.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Our system is based on four components: it has many data files (the weather, people, places, etc.); it has procedures which it tries to use to combine these files by working out how to respond to certain types or patterns of questions (this entails the user knowing what types of questions it can answer); it has a form to understand the questions posed in a natural language (so the user may need to know English) which it then translates into one of the types of questions it knows how to answer; finally, it has a very powerful display module, which it uses to show the answers, using, graphs, maps, histograms etc.	Our system is based on four components. Firstly, it has many data files, for example the weather, people, and places. Secondly, it has procedures which it tries to use to combine these files by working out how to respond to certain types or patterns of questions and this entails the user knowing what types of questions it can answer. Thirdly, it has a form to understand the questions posed in a natural language, which means the user needs to know English. It then translates the natural language into one of the types of questions it knows how to answer. Finally, it has a very powerful display module, which it uses to show the answers. These answers are shown using graphs, maps, histograms etc.

The RV is longer than the OV but it is much clearer for the reader because it:

- uses six short sentences rather than one long one. The semicolons have been replaced by full stops.
- clearly distinguishes the four components by using *firstly, secondly* etc.
- removes the brackets

3.17 Phrases in parentheses

Phrases in parentheses can considerably increase the length of a sentence. Parentheses are best used just to give short lists that act as examples. For example:

> Several members of the European Union (e.g. Spain, France and German) have successfully managed to reduce their top tax threshold from 42 to 38%.

In the example above the information in parentheses does not interrupt the logical flow of the sentence and it does not occupy much space.

Parentheses should be avoided when giving explanations or examples that are not lists. For example:

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Using automatic translation software *(e.g. Google Translate, Babelfish, and Systran)* can considerably ease the work of researchers when they need to translate documents thus saving them money *(for example the fee they might have otherwise had to pay to a professional translator)* and increasing the amount of time they have to spend in the laboratory rather than at the PC.	Using automatic translation software *(e.g. Google Translate, Babelfish, and Systran)* can considerably ease the work of researchers when they need to translate documents. Such software saves them money, *for example the fee they might have otherwise had to pay to a professional translator.* It also increases the amount of time they have to spend in the laboratory rather than at the PC.

In the OV the first use of parentheses is fine, but the second interrupts the flow of the sentence and considerably adds to its length.

3.18 Summary

You don't lose any of the complexity of your thought by dividing up a long sentence into shorter ones. The information contained is exactly the same. All you have done is to present that information in a way that is easy for the reader to absorb at a first reading.

To increase readability:

- don't separate the subject from its verb using more than 8–10 words
- avoid adding extra information to the end of the main clause, if the main clause is already about 15–20 words long
- check to make sure that a sentence has a maximum of 30 words, and don't use more than three or four 30-word sentences in the whole paper
- consider beginning a new sentence if the original sentence is long and contains one or more of the following (or equivalents): *and, which,* a link word, the *-ing* form*, in order to*
- maximize the use of periods (.). Use the minimum number of commas (,), avoid semicolons (;) and parentheses
- don't worry about repeating key words. If dividing up a long sentence into shorter sentences means that you have to repeat key words, this is not a problem. In fact this repetition will increase the clarity of your writing

Note: using *and, which* and the *-ing* form often leads to ambiguity (Sects. 6.1–6.5).

Chapter 4
Structuring Paragraphs and Sentences

Why is this chapter important?

One of the most common reasons why referees reject a paper is poor readability.

This chapter introduces various ways to make your writing easy to read and 100% clear for your readers by being reader-oriented. You will learn where readers expect to find the key information in a text, and how you can exploit this knowledge to give your writing maximum impact.

The result will be a high level of readability of your paper, in which readers will be able to understand everything in just one reading. This will be critical in influencing the referees whether to accept or reject your paper – anything that has to be read twice for it to be understood will decrease your chances of publication.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_4,

What the experts say

It's far more difficult to be simple than complicated.

John Ruskin, English art critic and social thinker

Human beings are not logical mechanisms into which information can be fed.

Bruce M Cooper, author of "Writing Technical Reports"

4.1 The key to good writing: always think about the reader

Good writing very much depends on the role that you expect the reader to play and the effort you expect them to make. But this role varies considerably from culture to culture. Congjun Mu, Vice Dean of the Faculty of Foreign Languages, Shanghai Institute of Technology in China explains:

> A key factor in Eastern rhetoric is reader-responsibility, which means that the reader is responsible for making all the connections between sentences, paragraphs and overall ideas that the author has laid out in his/her paper. This is distinguished from writer-responsibility in English rhetoric, where the reader is expected to make less effort and can thus hopefully absorb the argumentation rapidly.

In good English technical writing, the author writes in such a way that minimal effort is required by the reader. The writer is nearly 100% responsible for whether the reader understands the text or not. Reader-centered writing also means that more people will appreciate your paper, and thus they will be more likely to cite it in their own papers.

Try reading the following text.

> NON-NATIVESPEAKERSTYPICALLYSAYTHATENGLISHISASIMPLELANGUAGE BECAUSE IT FAVORS SHORT CLEAR SENTENCES SuCh NoN-nAtiVe spEAkeRS thEn saythattheirownlanguageisnotlikeEnglishbecauseitfavorslong complex sentences

The passage above is difficult to read because it is not how a text is usually presented. The same effort that it took you to read the above passage is similar to the effort that will be required by a referee or native English speaker to follow your text if it is poorly structured, and full of ambiguity and redundancy. Poor readability has a monetary cost. If you force your reader to spend a lot of energy and time on deciphering your papers, you are also stopping them from spending the same time and energy on their work.

To write well, you need to know exactly how people read.

Today, much reading is done directly from a screen, rather than from a hard copy. Because we generally want information fast, particularly when searching on the Internet, we tend to scan. Scanning means not reading each individual word, but jumping forwards three or more words (or sentences) at a time. The distance that we jump (in terms of number of words or sentences) depends on the value that those words are adding in our search for information. If they add no value we tend to jump further.

If we continue to get no value, instead of scanning left to right along a line of text, we scroll from top to bottom. We thus read vertically rather than horizontally until we find what we want.

In an article in the British newspaper The Guardian, Tracy Seeley, an English professor at the University of San Francisco, noted that after a conversation with some of her students she discovered that “most can’t concentrate on reading a text for

more than 30 seconds or a minute at a time. We're being trained away from slow reading by new technology." In an email to me she added that "papers need to get to the point quickly" and that "good writing is even more important now in order to hold reader's attention".

The same Guardian article quoted two research projects, the Poynter Institute's Eyetrack survey, and an analysis by Jakob Nielsen (a Danish web usability expert), whose results show that only half of readers who begin an article, will actually finish it, and if the article is read online, only a fifth of readers will finish it.

This has huge implications for you as a writer. No one will be under any obligation to read your paper. If readers don't find it useful or interesting or at least pleasurable, and they have the feeling that it was not written with them in mind, they will simply stop reading. Your findings will then be lost in oblivion.

Every word you write needs to be understood by the reader. The style should be specific, emphatic and concise. Everything should be relevant. Readers are generally lazy and in a hurry. They need to be able understand everything the first time they read. Don't force your reader to wait till the end of a sentence, paragraph or section in order to be able to put all the pieces of the jigsaw together. Instead of a jigsaw, a good writer of English has a chain as a writing model. Within a sentence, each word forms a chain to make the meaning of the sentence clear. And each sentence forms a chain with the next, so that the reader is guided link-by-link and step-by-step towards the writer's conclusions.

4.2 General structure of a paragraph

Every paper has a title and the readers know where to find it, i.e. at the top of the first page of the paper. Readers know that the title will be followed by the Abstract and at (or towards) the end of the paper they expect to find the Literature Cited.

Just as readers have certain expectations with regard to the structure of the entire paper, they also have expectations with regard to how a section, paragraph and a sentence should be structured. These expectations are less conscious or explicit than expectations regarding the position of a title and the abstract. However they are based on how readers usually find and receive information in a section, paragraph and sentence.

Each paragraph is like a microcosm of a paper – it has its own title (the topic sentence), the intermediate sentences are like the sections of the paper, and the last sentence is like the conclusions.

A well-structured paragraph in any other part of a section (i.e. not the first paragraph) is thus generally as follows:

1. A topic sentence that tells the reader what the paragraph is about and in some way connects with the previous paragraph.
2. From one to eight sentences in a logical sequence that develop the topic.
3. A concluding sentence, possibly referring back to the first sentence or forward to the next paragraph.

The three elements of this structure are dealt with in detail in the subsections below. Your aim is to show readers how your paragraph fits in with what came before and what is coming after. You need to organize your information for the reader, rather than the reader trying to organize the information that you have given him / her. Only one specific idea should be covered in each sentence, and only one general idea in each paragraph.

4.3 How to structure a paragraph: an example

In the early 1960s, senior staff scientist at NASA, Sam Katzoff wrote a 30-page pamphlet entitled 'Clarity in Technical Reporting'. This short document was designed to help his colleagues at NASA to write clearly and to think of better ways to express themselves. In 2009, Katzoff celebrated his 100th birthday, and his pamphlet is still being read - not just by NASA scientists - but all over the English-speaking world. It is a truly great introduction to writing skills, for native and non-native speakers alike. It can be downloaded for free, see page 309.

I am now going to analyze how he writes the first paragraph at the beginning of his section entitled 'Organization of a Technical Report'.

> Different writers have different methods of organizing their reports, and some seem to have no discernible method at all. Most of the better writers, however, appear to be in remarkably close agreement as to the general approach to organization. This approach consists of stating the problem, describing the method of attack, developing the results, discussing the results, and summarizing the conclusions. You may feel that this type of organization is obvious, logical, and natural. Nevertheless, it is not universally accepted. For example, many writers present results and conclusions near the beginning, and describe the derivation of these results in subsequent sections.

Let's begin with some statistics.

WORDS, SENTENCES, PUNCTUATION	REPETITIONS OF KEY WORDS
Total words = 101	*approach* 2
Total sentences = 6	*method* 3
Average words per sentence = 16.8	*organization* 3
Longest sentence = 22 words	*results* 4
Shortest sentence = 6 words	*writer* 3
Full stops (.) = 6	
Commas (,) = 10	
Semi colons (;) = 0	

If you analyzed a paragraph in a typical research paper, you would very likely get very different data. Try looking at some of your own work. With respect to Katzoff's paragraph, you will probably notice a big increase in the number of words, commas and semicolons per sentence. The typical sentence length will be around 30–40 words, but also up to 70–80. I imagine there will also be a considerable decrease both in the number of full stops and in repetitions of key words.

Sam Katzoff was a top scientist. His document was intended for fellow scientists, who were, like him, native English speakers. These fellow scientists were also amongst the most brilliant scientists in the world. They could potentially understand even the most complex text. Yet Dr Katzoff decided to write his document in the simplest and clearest way possible, and he encouraged his fellows to do the same. According to a fellow colleague:

> He was the kind of person who could look at a paper and tell whether it was a lot of bull. If you were writing a paper and were publishing, he would review it and that would help a lot of people in the field to come up with a better way of saying what they were trying to get across.

By *bull* the colleague was politely saying *bullshit*, i.e. words, phrases and paragraphs that clearly made no sense, but were just included for effect.
Now let's analyze the structure of Katzoff's paragraph.

> (S1) Different writers have different methods of organizing their reports, and some seem to have no discernible method at all. (S2) Most of the better writers, however, appear to be in remarkably close agreement as to the general approach to organization. (S3) This approach consists of stating the problem, describing the method of attack, developing the results, discussing the results, and summarizing the conclusions. (S4) You may feel that this type of organization is obvious, logical, and natural. (S5) Nevertheless, it is not universally accepted. (S6) For example, many writers present results and conclusions near the beginning, and describe the derivation of these results in subsequent sections.

S1 introduces the general topic and summarizes current practice with regard to report writing. S2 qualifies what was said in S1. The reader is warned of this qualification by the link word *however*.

Katzoff repeats the word *writer* from S1 to link it into S2, but precedes it with a different adjective (*different, better*) to show that he is moving from something general (all authors) to something more specific (better authors). The repetition of *approach* in S3 serves a similar linking purpose. It gives readers the feeling that they are being guided step by step along the path by which Katzoff develops his topic.

In S4 he addresses the reader directly, which is probably something that you would not do in a paper. Instead you would probably phrase such a concept in the passive: *it may be argued that*. Katzoff's idea is to anticipate possible objections to what he is about to say. S5 is only six words long. Such a short sentence is rare in academic

work. Yet it is very effective in capturing reader attention. The link word, *nevertheless*, placed prominently at the beginning of the sentence, also catches the reader's eye and helps to underline the importance of what is being said.

In S6 he uses another link word, *for example*. These link words all serve to show how each sentence relates to what has been said before. Without these link words, the reader would be forced to figure out Katzoff's train of thought. However, Katzoff only uses link words when they really serve a purpose.

As can be seen in the second column of the table on page 57, one constant device Katzoff uses is to repeat words. He uses the word *writer* three times. He could easily have found synonyms, e.g. author, researcher, technician. But this might have confused readers who might think that there was a difference in meaning between these terms.

Another massive aid to helping readers understand, is to have a maximum of two ideas per sentence. S4 and S5 contain just one idea. S6 contains two ideas linked by *and*.

4.4 First paragraph of a new section - begin with a mini summary plus an indication of the structure

Readers do not necessarily read the paper from beginning to end. They may begin with any section in the paper.

This means you could consider starting some sections (e.g. Introduction, Discussion, Conclusions) with a one or two-sentence summary of the main aims and/or findings of the paper. This style is also typical if you are writing chapters in a book.

However, check the general style of papers in your chosen journal. If they do not begin sections in such a way, then don't do it yourself. Instead go for a more direct approach (see Sect. 4.5).

Here are some examples of mini summaries at the beginning of a section:

> The X Committee has for some years encouraged collaborative clinical trials in X by reporting the results in the medical literature. In this section we describe the first of two unreported results that we believe deserve such publication and which constitute the main contribution of this paper.
>
> As mentioned in the Introduction, a principal concern in the field of X is to understand why ... This section attempts to answer the question ...
>
> Our aim is to provide a simple alternative to the complex theoretical models that attempt to explain ... In this section we present a simplified model, which we believe is ...

This section reviews the process of ... This process provides the backbone to the system that is at the core of our research.

In addition to this mini summary, some authors also briefly outline what will be contained in the rest of the section. Here are four examples:

S1. In this section, we briefly review the broad perspectives that have shaped the direction of thinking about …

S2. In this section, the numerous advances in cosmology are described, with emphasis on the vast new area of …

S3. In this section, we will ask the question: 'Under what circumstances will a paper be rejected?'

S4. In this section we define our approach and show how it can be very naturally used to define distributions over functions. In the following section we show how this distribution is …

The examples highlight different styles for introducing the topic. S1 and S2 are the standard approach, using a personal style (*we* in S1) and an impersonal style (the passive form in S2). S3 represents a variation because it asks a question – this may be a good solution for creating some variety in the way you begin each section.

Note how in S4 the author also refers to future sections. Such references help the reader to see how the current section fits in with the logical progression of the rest of the paper. However, you should keep such references as short as possible as they can become quite heavy and annoying for the reader.

4.5 First paragraph of a new section - go directly to the point

Particularly in shorter papers, you may not have the space to have mini summaries at the beginning of your section or subsections. In any case, readers often don't have the time or the inclination to read them. In such cases you need a more direct approach.

Being direct does not necessarily entail telling the reader what you did, but telling them what it means. A typical sentence to open the Results section is:

S1. An analysis of the number of words used in English with respect to Italian, showed that the average sentence in English was 25 words long, whereas in Italian was 32 words long (see Table 1). This indicates that when an Italian document is translated into English, there is …

A much more direct approach is to say:

S2. Italian tends to use more words per sentence than English, so when an Italian document is translated into English, there is …

S2 begins with the main information, and then provides the implications. You do not necessarily need to tell the reader the exact details what you did (this would be more appropriate in Methods) but just what you found.

4.6 Deciding where to put new and old information within a paragraph

Known information is traditionally placed at the beginning of a sentence or paragraph. Below are the first three sentences from the abstract of a fictitious paper entitled 'Readability and Non-Native English Speakers' intended for a journal dedicated to communication in the world of business.

> VERSION 1 Readability formulas calculate how readable a text is by determining the level of difficulty of each individual word and the length of sentences. All types of writers can use these formulas in order to understand how difficult or readable their texts would be for the average reader. However, readability formulas are based purely on what is considered difficult for a native English speaker, and do not take into account problems that may be encountered by non-natives. In this paper ...

The first word, *readability*, is one of the author's key words. It immediately alerts the reader to the topic of the sentence and of the abstract (and paper) as a whole. However, the information contained in it is not new - readability formulas and their indexes are well established in the literature on business communication.

The role of the first two sentences is thus to set the context and gently guide the reader into the paragraph. The third sentence then introduces the new element, i.e. the fact that readability indexes do not take into account non-native speakers. The third sentence thus highlights the problem that the paper intends to tackle.

However, the abstract could have begun like this:

> VERSION 2 Current readability formulas are based purely on what is considered difficult for a native English speaker. They fail take into account problems that may be encountered by non-natives. One thousand five hundred PhD students from 10 countries were asked to evaluate the difficulty of five technical texts from their business discipline written by native English speakers. Three key difficulties were found: unfamiliar vocabulary (typically Anglo-Saxon words), unfamiliar cultural references, and the use of humor. The paper also proposes a new approach to assessing the level of readability of texts to account for such difficulties.

In Version 2, the author still begins with his key word, *readability*. But he precedes it with *current*, which signals to the reader that the author will then probably propose an alternative. The author also assumes that his readers will be aware of what a readability formula is, so he feels he doesn't need to mention it. Thus, in the second sentence he immediately underlines a critical problem with current formulas. In the third sentence he then tells his readers what his research was and then what was found.

Version 3, below, contains only new information.

> VERSION 3 Unfamiliar vocabulary (typically Anglo-Saxon words), unfamiliar cultural references, and the use of humor: these, according to our survey of 1500 PhD students, are the main difficulties non-native speakers have when reading a business text in English. Our

results highlight the need to adjust current readability formulas in order to take non-native speakers into account. The paper also proposes a new approach to assessing the level of readability of texts to account for such difficulties.

This version is designed to immediately attract the reader's attention. In contrast, the first 50 words of Version 1 contain no new information at all. Version 2 has 40–50% new information or more, depending on whether readers are familiar with the limitations of readability formulas with regard to non-natives.

So, which version should you use?

The best version to use depends on two factors:

1. the section of the paper
2. what you are trying to achieve

Version 1 would only be appropriate in an Abstract if the journal where it is being published does not usually deal with communication and / or readability indexes. In this case the readers need the context to be set for them. It might be more acceptable in an Introduction in a slightly more specialized journal. In an Introduction the aim is not principally to attract attention, if readers are reading your Introduction you can presume that you already have their attention.

So the information contained in Version 1 would be used in an Introduction just to remind the readers of the context. This is a very typical way to begin an Introduction - it is what readers expect and therefore it is generally a good technique.

Version 2 would be appropriate as an Abstract or Introduction in a specialized journal on business communication.

Version 3 would only be appropriate in an Abstract and exclusively in a very specialized journal. It can only be used if you have clear findings, or a clear new methodology, to report. It works very well because it does not force readers to read background information that they are probably already familiar with.

You might also choose Version 3 as an Abstract for a congress. In such cases you are competing for the attention of the referees who will use your Abstract to decide whether to include your contribution at the congress. If your Abstract is accepted, you will then be competing with other authors / presenters in motivating the audience to come and watch you rather than a parallel session.

In many languages Versions 2 and 3 would not be acceptable. In the words of one of my Greek PhD students:

> New information in Greek comes at the very end. The rule is that first the author gives extensive background information and only at the end he / she introduces the new concept. This is the generally accepted (and considered correct) way of writing.

This means that when you write in English you may be going against what is considered good style in your own language. But don't let breaking a taboo stop you from expressing yourself in the way that will best highlight your results and thus attract more readers.

4.7 Deciding where to put new and old information within a sentence

S1 and S2 begin with the same subject *English*, which is the main topic of the sentence. They then present the same two pieces of information, but in a different order.

S1. English, which is the international language of communication, is now studied by 1.1 billion people.

S2. *English, which is now studied by 1.1 billion people, is the international language of communication.

In both cases if you removed the 'which' clause (in italics) the sentence would still make sense. But if you removed the final clause it wouldn't. This would seem to indicate that the final clause is where we locate the most important information. Thus the relative position of the various parts of the phrase tells the reader the relative importance of the information contained on those parts.

In S1, the order of the information tells you that the fact that English is *the international language of communication* is old news, but that *1.1 billion people* is new information that the reader probably does not already know. Thus, the order of the information in S2 is a little strange because it puts the new information (*1.1. billion people*) before the old information (*international language*).

Readers tend to focus on the first and last words of a sentence, so avoid placing your most important information in the middle of a long sentence. Readers don't want to make an effort to identify the key points, they want to be told immediately.
Here are some more examples that show how by changing the order of information within a sentence you can achieve a different effect:

S3. English is now studied by 1.1 billion people, though this number is expected to drop with the rise in importance of Chinese.

S4. Although English is now studied by 1.1 billion people, this number is expected to drop with the rise in importance of Chinese.

S5. Although the importance of Chinese is expected to lead to a drop in the numbers of people studying English, 1.1 billion people still study English.

S3–S5 all contain the same information, but the weight that this information is given varies.

In S3 the reader learns some information. This information is then qualified with *though*, which is used to introduce some new information that the author imagines that the reader does not know.

In S4 the reader is immediately alerted to the fact that the information contained at the beginning of the sentence is going to be qualified by new information in the second part. The order of the information in S4 is thus more logical than in S3.

In S5 the writer assumes that the reader already knows the importance of Chinese and instead focuses on the fact that despite the increase in the number of Chinese speakers, English is *still* studied by a lot of people. 'still' is the key word and it is located very close to the end of the sentence.

In S1–S5 there are two parts to each sentence, and the writer gives more emphasis to the second part. Sometimes, you may want to give equal weight to the two parts.

S6. English is the international language of communication. It is now studied by 1.1 billion people.

S7. The importance of Chinese is expected to lead to drop in the numbers of people studying English. Despite this, 1.1 billion people still study English.

In S6 and S7, the writer wants the reader to notice and absorb the two pieces of important information separately. She does this by presenting the information in two distinct sentences. This device should not be used too often because it can lead to a series of very short sentences, which after a while begin to sound like a list.

4.8 Link each sentence by moving from general concepts to increasingly more specific concepts

A key issue when linking up sentences in a paragraph is to decide how to link one sentence to the previous one. The following is an extract from the beginning of a paragraph from a paper on pollution in soil. It fails to make a strong impact because of its lack of logical progression.

> (S1) The *soil* is a major source of *pollution*. (S2) Millions of *chemicals* are released into the environment and end up in the soil. (S3) The impact of most of these *chemicals* on human health is still not fully known. (S4). In addition, *in the soil* there are naturally occurring amounts of potentially *toxic substances* whose fate in the terrestrial environment is still *poorly known*.

S1 puts *the soil* as the topic of the sentence. S2 is more specific and talks about the quantity of this pollution - *millions of chemicals*. S3 reports the impact of the chemicals mentioned in S2. But S4 does not continue this logical progression from general to increasingly more specific. Instead, it begins by putting *soil* in the topic position. This breaks the logical progression, because *soil* was the topic of S1. The following sentence would be a good replacement for S4, which would thus continue the logical structure developed in S1–S3.

> S5 There are also naturally occurring amounts of potentially toxic substances *in the soil* whose fate in the terrestrial environment is still poorly known.

The formula is thus:

1. S1: main topic (*soil*) introduces subtopic 1 (*pollution*)
2. S2: subtopic 1 is specified by introducing subtopic 2 (*millions of chemicals*).
3. S3: subtopic 2 is specified introducing subtopic 3 (*impact of these chemicals*).
4. S4: a further / related aspect of subtopic 3 is introduced via subtopic 4 (*impact of toxic substances, i.e. chemicals, is poorly understood).*
5. etc.

Basically each sentence is link in a chain. A full chain is a paragraph. And a series of linked chains makes up a section.

This concept of a chain of logical progression is not common to all languages. Here is what Nobel Prize Winner in Physics, Tony Leggett, notes about Japanese:

> In Japanese it seems that it is often legitimate to state a number of thoughts in such a way that the connection between them, or the meaning of any given one, only becomes clear when one has read the whole paragraph or even the whole paper. This is not so in English; each sentence should be completely intelligible in the light of what has *already* been written. Moreover, the connection between one thought and the next should be completely clear when it is read; for instance, if you deviate from the 'main line' of the thought to explore a side-track, this should be made clear at the point where the sidetrack *starts*, not where it finishes.

4.9 Present and explain ideas in the same (logical) sequence

Readability can be increased massively if you take some time to think about the best way to present information. The OV below is in perfect English, and it may seem fine until you see how the RV makes the information much easier to assimilate.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Memory can be subdivided into various types: long-term memory, which involves retaining information for over a minute, and short-term memory, in which information is remembered for a minute or less, for example, the memory required to perform a simple calculation such as 5 × 7 × 3. Another type of short-term memory is also recognized: sensory memory, for example we see a video as a continuous scene rather than a series of still images. Research shows sex differences in episodic (i.e. long term) memory: women tend to remember better verbal situations, whereas men have a better recollection of events relating to visuals and space. Long-term memory can be further subdivided into recent memory, which involves new learning, and remote memory, which involves old information.	Memory is the capacity to store and recall new information. It can be subdivided into two main types: short-term and long-term. Short-term memory involves remembering information for a minute or less, for example, the memory required to perform a simple calculation such as 5 × 7 × 3. Another type of short-term memory is sensory memory, for example, we see a video as a continuous scene rather than a series of still images. Long-term memory can be further subdivided into recent memory, which involves new learning, and remote memory, which involves old information. Interestingly, research shows sex differences in remote memory: women tend to remember better verbal situations, whereas men have a better recollection of events relating to visuals and space.

In the OV, the beginning of the first sentence gives the illusion to the reader that the various types of memory will be introduced in a logical order. In reality a rather random selection of information is given, with no clear sequence. This makes it hard for the reader to follow. The RV uses shorter sentences and follows a much more logical series of steps:

(1) definition of memory given

(2) clear indication of the number of types of memories (OV *various* types, RV *two main* types)

(3) short-term memory mentioned first, as later in the paragraph long-term memory will be developed in more detail

(4) additional information about short-term memory (the discussion of short-term memory ends here)

(5) returns to second topic (long-term memory), which is then subdivided into *recent* and *remote*

(6) interesting fact about remote memory

In the RV, each sentence extends the information given in the previous sentence, and the reader can sense the logical progression. The author presents a list of topics at the beginning of a paragraph that he intends to discuss further in the later part of the paragraph. He then deals with the topics in the same order and format as he initially presented them: first short-term memory, then long-term.

4.10 Don’t force the reader to have to change their perspective

Your aim is to provide readers with a step-by-step approach to enable them to understand your reasoning. It must be clear from the beginning of your sentence what this logical progression is. This means that at mid point or end point in a sentence, readers should not have to change their perspective of this logical progression. OVs 1–5 below are all correct English, but they don’t help the reader to follow your logical flow.

	ORIGINAL VERSION (OV)	REVISED VERSION (RV)
1	It is important to remark that our components are of a traditional design. *However*, we want to stress that the way the components are assembled is very innovative.	*Although* our components are of a traditional design, the way they are assembled is very innovative.
2	Working in this domain entails modifying the algorithms as *we are dealing* with complex numbers.	*Since we are dealing* with complex numbers, working in this domain also entails modifying the algorithms.
3	Therefore, the rescaled parameters seem to be appropriate for characterizing the properties, *from a statistical point of view*.	Therefore, *from a statistical point of view*, the rescaled parameters seem to be appropriate for characterizing the properties.
4	The number of times this happens when the user is online is generally *very few*.	This *rarely* happens when the user is online.
5	Documentation on this particular matter is almost *completely lacking*.	There is *virtually no documentation* on this particular matter.
6	*Consequently we found this particular type of service not interesting.	Consequently we did not find this particular type of service interesting.

The RVs all provide signals to the reader about what they can expect next.

In OV1 readers initially think that *traditional design* is the key information that the author wants to give them. The author then introduces new information that completely contrasts with the preceding information. In such cases, you need to forewarn your readers of such contrasts by using a linker that introduces a qualification, such as *although*, at the beginning of the phrase (as in RV1).

In RV2 and RV3 the author immediately tells readers the point of view he wants them to assume, whereas in OV2 and OV3 this key information is only given at the end of the sentence. The strategy adopted in RV2 also enables you to present the information in chronological order: (1) what we already know (2) new information.

In the OVs 4–6, readers initially think that something affirmative is being said, but then they have to readjust their thinking when the negation is introduced at the end of the sentence. English tends to express negative ideas with a negation. This helps the reader to understand immediately that something negative is

being said (RV4 and RV5). OV6 is incorrect English because the verb and the negation (*not*) have been separated. Generally *not* is located immediately before the verb.

4.11 Use a consistent numbering system to list phases, states, parts etc.

When you need to describe the various stages in a procedure, methodology, project and so on, it helps to use a numbering system. For example, *first(ly), second(ly), third(ly), finally*. It is also important to continue your numbering system in the same way that you started it, and not to abandon it. Compare these two versions:

ORIGINAL VERSION	REVISED VERSION
Our methodology can be divided into three main parts: first of all the characterization of demographic changes between 2000 and 2010, in order to obtain a scenario for the future with regarding to population shifts. The results from this first part were used as inputs to obtain maps for 2010 to 2015. The resulting maps and input maps regarding climatic and political characteristics were inserted into our model in order to predict future patterns.	Our methodology can be divided into three main stages. *Firstly*, we characterized demographic changes between 2000 and 2010, in order to obtain a future scenario for population shifts. *Secondly*, we used the results from the first part as inputs to obtain maps for 2010 to 2015. *Finally*, the resulting maps along with input maps regarding climatic and political characteristics were inserted into our model in order to predict future patterns.

The OV is a little misleading. The colon in the first sentence gives the reader the impression that the author is going to mention all three stages together within the same sentence. The second two stages are not clearly marked. The RV separates the OV's first sentence into two parts. In the RV, first the author announces that there are three stages. Then she talks about these three stages in three separate sentences, which begin with a number indicator. This also makes the paragraph visually easier to follow.

4.12 Begin a new paragraph when you talk about your study and your key findings

If you have phrases such as *This study shows that* / *Our findings highlight* / *These results indicate that* in the middle of a long paragraph, readers may not even notice the sentence. Thus you lose a good opportunity to get the reader to focus on your findings. So whenever you want to highlight the importance of your study or findings, begin a new paragraph (Sect. 8.2).

4.13 Break up long paragraphs

The only advantage of a long paragraph is for the writer, not for the reader. It enables writers to save time because they avoid having to think about where they could break the paragraph up to aid reader comprehension. But breaking up long paragraphs is extremely important.

Firstly, long blocks of text are visually unappealing for readers, and tiring for their eyes. They fail to meet the basic rule of readability – make things as easy as possible for your reader. Evidence of this can be found in newspapers. If you look at newspapers from 100 years ago, they were basically big blocks of text that took a great deal of effort to read. Today many online newspapers have one sentence per paragraph, with lots of white space between each paragraph.

Secondly, your points and the related logical sequence of these points will be much more clearly identifiable for the reader if they are in a separate paragraph.

Thirdly, you will find that you will write more clearly if you use shorter paragraphs. This is because it will force you to think about what the main point of your paragraph is and how to express this point in the simplest way. If you just have one long paragraph, the tendency is just to have one long flow of frequently disjointed thoughts. This tendency is known in English as 'rambling'.

Fourthly, having shorter paragraphs enables you (and your co-authors) to quickly identify if you need to add extra information, and allows you to do this without having to extend an already long paragraph. Likewise, it enables you to identify paragraphs that could be cut if you find you are short of space.

The third and fourth points are also valid reasons for using short sentences (see Chap. 5).

The maximum length of a paragraph in a well-written research paper is about 15 lines. But most paragraphs should be shorter. If you have already written more than 8–12 lines or 4–6 sentences, then you may need to re-read what you have written and think about where you could start a new paragraph.

When you begin to talk about something that is even only slightly distinct from what you have mentioned in the previous 4–6 sentences, then this is a good opportunity to begin a new paragraph. For example, when you have been talking about how another author has approached the problem of X, and you then want to make a comparison with your own approach. The topic (i.e. X) is the same, but the focus is different. Likewise, if you have been comparing X and Y, and you have spent a few sentences exclusively on X, then when you start on Y you can use a new paragraph.

Basically, there is an opportunity to begin a new paragraph every time there is a change in a focus.

4.14 Look for the markers that indicate where you could begin a new sentence

The table below shows the typical phrases used to connect one sentence to the next in order to create a logical progression of thought. These typical phrases also act as markers to indicate that you could begin a new paragraph.

TYPICAL PHRASES	FUNCTION OF THE PHRASE
In order to do this / To this end / With this mind	To state the purpose of something. For instance, you outline a requirement, and then you begin to say how you could meet this requirement
Then / Following this / Afterwards	To indicate a temporal relationship
For example, / *An example of this is* / *In fact,* / *Unlike* / *Nevertheless,*	To give an example or supporting/negating evidence. By 'example' I don't mean just a list of items, but a complete example or evidence that supports or negates what you have just been saying and that requires several sentences to explain
In addition / Another way to do / An additional feature of	To add additional points. For instance, if you are focusing just on one thing (e.g. X) and you talk about X's attributes
On the other hand / *However* / *In contrast*	To qualify what you have just said: i.e. to indicate an exception or the two sides of an argument
Due to / Since / Although	To give reasons for something
Thus / Therefore / Consequently / Because of this	To indicate a consequence
This means that / This highlights that / These considerations imply that / In conclusion / In sum	To announce and give a mini conclusion about what you have said in the previous sentences
Figure 1 shows / As can be seen in Table 2	To talk about figures, tables etc.
Firstly, secondly, finally	To introduce elements in a list
As far as X is concerned, / In relation to X, In the case of / With regard to / As noted earlier	To introduce a new element; to recall something mentioned earlier
It is worth noting that / Interestingly	To add some additional information or make some comment, not necessarily directly about something you have mentioned before but as an aside.

In all the examples in the table, I am talking about cases where you need at least three sentences (or two quite long ones) to achieve the function desired. For example, when you use *firstly, secondly* etc., you only need to begin a new paragraph if the sentence that begins *firstly* is then followed by another two or more sentences. If you only need one sentence for each item, then you don't need to begin a new paragraph.

There is no minimum length to a paragraph. A paragraph can occasionally be just one sentence. However, a series of paragraphs containing only one or two short sentences would be a little strange.

Where you begin a new paragraph will also depend on which section you are writing. In the review of the literature, you may want to begin a new paragraph when (i) you begin to talk about a different phase in the logical build up of research in your field, or (ii) you start talking about another author. In the Methods, it may help the reader to identify the various components or understand the various steps, if these components or steps are in separate (probably quite short) paragraphs.

4.15 Concluding a paragraph: avoid redundancy

Throughout this section I have underlined the need to help the reader understand the logical progression of your ideas. But if your writing is clear, you don't need to help the reader too much. This means that the beginning of a paragraph should move on from where the previous paragraph ended. So there is no need for a summary sentence between the two paragraphs, but just a clear and logical link in terms of advancing one idea to the next.

So avoid making constant mini-summaries, some readers might begin to get bored and start skipping whole paragraphs. A good test of whether you need mini summaries, is to remove them, and show the resulting paper to a colleague. If the colleague can follow your argumentation clearly and makes no comment about summaries being needed, you can remove them definitively.

Many authors only use a mini summary at the end of the Introduction. This is probably because this is one of the parts of the paper where the author is not talking exclusively about his/her work, but is using other works to motivate his/her own and thus needs to highlight this for the reader. If authors have no separate Conclusions section, then they also make an extended summary at the end of the Discussion.

Some authors end a section by talking about the coverage of the next section, but such information is often redundant, particularly if it is repeated again at the beginning of the next section.

4.16 Summary

- Always think about your readers – order the information you give them in the most logical way and in the simplest form.
- Begin each paragraph with a topic sentence, then use the rest of the paragraph to develop this topic. If appropriate have a short concluding sentence at the end of the paragraph.
- Decide whether to begin a new section with a short summary, or whether to go directly to the main points.
- Put the topic as the subject of the paragraph or sentence, then give known information (context, background) followed by new information. Consider not giving the known information if it will be obvious for your readers.
- Move from the general to the increasingly specific, do not mix the two.
- Always progress in the most logical and consistent order, do not go backwards and forwards.
- Don't force readers to change their perspective: put negations and qualifying phrases at or near the beginning of a sentence.
- Break up long paragraphs and begin a new paragraph when you talk about your study and your key findings
- Avoid redundancy in the final paragraph of a section.

Chapter 5
Being Concise and Removing Redundancy

Why is this chapter important?

Being concise is not an option. Many journals, particularly widely-read ones such as *Science* and *Nature*, have severe restrictions on the number of words per article. The space they have available is precious.

Also, certain documents have strict limits with regard to the number of words allowed, for example Abstracts and grant proposals. CVs, posters and slides also tend to have a limited space available.

This chapter will teach you how to be concise without losing any important content, i.e. you can express the same concepts but using fewer words.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_5,

What the experts say

A good scientific theory should be explicit to a barmaid.

Ernest Rutherford, British / New Zealand chemist and physicist

The ability to simplify means to eliminate the unnecessary so that the necessary can speak.

Hans Hoffman, German-born American abstract expressionist painter

I don't want to bother readers unless I think it is important.

Barbara Kingsolver, American novelist

5.1 Cut, cut and then cut again

Being concise means using the least amount of words to express a concept, without losing any content or detail. A word or phrase is redundant if it does nothing to help the reader understand a sentence.

S1 and S2 contain considerable redundancy:

S1. *The research focused the comparison between the year 2003, when a severe spring frost occurred, and the 2006–2008 period, characterized by a lack of natural spring frosts.

S2. *There is a wide variety of studies dealing with the evaluation and the achievement of clarity in technical manuals. We will discuss a certain number of them that in our opinion are of particular interest to our research.

Here are concise versions of the above:

S3. We compared 2003, when a severe spring frost occurred, with 2006–2008, when there were no natural spring frosts.

S4. Several studies on clarity in technical manuals can be found in the literature [for a review, see refs. 10 and 15]. We discuss three papers that we believe are most relevant to our research.

If your reader has to search for key information that is hidden in a mass of redundant words then you are forcing them to make an unnecessary effort. Also, if readers find redundancy in the first sentences of a text, they will assume that there is a good chance that the rest of the text also contains redundancy. This means that they will start to read quickly and instead of reading each individual word, they will start to scan, i.e. to read one in five or six words.

Before having her paper revised, one of my clients received the following comments from a referee:

> The paper was extremely long and must be massively reduced in length. … It was packed full of vague statements …. The abstract was far too long. …The opening sections were superfluous … I would like to see some concrete examples, rather than the somewhat long-winded technical explanations that were not very clear. The author could easily reduce the length by 25%. This can be achieved without removing any real content and I believe that the result would be that the paper would read more fluently and the pace would be quicker.

These comments were not directed at the level of her English (which is very high) but simply at her style of writing.

Everything you write should add value. Don't just cut words. Consider cutting sentences, paragraphs, even whole subsections. If you eliminate the unnecessary and try to be precise, your important points will stand out clearly for the reader.

5.2 Write less, make less mistakes

The less you write, the fewer opportunities you will have to make mistakes in your English! For example, imagine you are not sure in S1 if *aimed* should be followed by *at* or *to*, or in S2 whether *choice* or *choose* is the correct spelling of the noun.

S1. The activity aimed *at / to* the extrapolation of the curve is not trivial.

S2. We did the calculation manually. This *choice / choose* meant that …

If you make the sentences more concise by removing the redundancy you will avoid the problem and thus avoid risking making a mistake when using them! So S1 and S2 could be rewritten as S3 and S4.

S3. The extrapolation of the curve is not trivial.

S4. We did the calculation manually. This meant that …

By the way, *aimed at* and *choice* would be the correct versions in S1 and S2.

5.3 Cut redundant words

The words in square brackets below are probably all redundant, and could simply be removed without having to make further changes to the sentence.

It was small [in size], round [in shape], yellow [in color] and heavy [in weight].

This will be done in [the month of] December for [a period of] six days.

Our research [activity] initially focused [attention] on [the process of] designing the architecture.

The [task of] analysis is not [a] straightforward [operation] and there is a [serious] danger that …

The analyses [performed in this context] highlighted [among other things] the [fundamental and critical] importance of using the correct methodology in a consistent [and coherent] manner [of conduction].

Note how the words that have been cut are more generic than the words that have been left (e.g. *color* rather than *yellow*). Wherever possible use the most concrete word available.

Words such as *activity* and *task* add no value to what you are saying. They are very abstract and not memorable words for the reader. If you find that your paper is full of the words listed below, first decide if you could cut them, if not try to find a more concise and concrete alternative.

activity, case, character, characteristics, circumstances, condition, consideration, criteria, eventuality, facilities, factor, instance, intervention, nature, operation, phase, phenomenon, problem, procedure, process, purpose, realization, remark, situation, step, task, tendency

Whenever you use an adjective or adverb decide if it really is necessary. And don't use pairs of adjectives or nouns that essentially mean the same thing. What contribution, if any, do the words in square brackets below add to the reader's understanding of the sentence?

This has made it possible to review the analysis of important [fundamental and practical] problems [and phenomena] of engineering.

Numerical methods have increasingly become quick [and expedient] means of treating such problems.

Equation 1 is [readily] amenable to numerical treatment.
The method lends itself [most amiably] to being solved by …

5.4 Prefer verbs to nouns

English tends to use more verbs than nouns. This reduces the number of words needed, makes sentences flow better, and provides variety. Too many nouns make a sentence heavy to read.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
X was used in the *calculation* of Y.	X was used to *calculate* Y.
Symbols will be defined in the text at their first occurrence.	Symbols will be defined *when they first occur* in the text.
Lipid *identification* in paint samples is based on the *evaluation* of characteristic ratio values of fatty acid amounts and *comparison* with reference samples.	Lipids are generally *identified* in paint samples by *evaluating* the characteristic ratio values of fatty acid amounts and *comparing* them with reference samples.

5.5 Use one verb (e.g. *analyze*) instead of a verb + noun (e.g. *make an analysis*)

If you use a verb + noun construction, you have to choose a 'helper' verb to associate with the noun. For example, should you say *do* or *make* a comparison of x and y? If you simply say *to compare x and y*, you avoid choosing the wrong helper verb.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
X *showed* a better *performance* than Y.	X *performed* better than Y.
Heating of the probe can be *obtained* in two different ways:	*The probe can be* heated *in two different ways*:
The *installation* of the system is *done* automatically.	The system is *installed* automatically.
The *evaluation* of this index *has been carried out* by *means* of the correlation function.	This index was *evaluated using* the correlation function.

Other examples:

> *achieve* an improvement (improve), *carry out* a test (test), *cause* a cessation (stop), *conduct* a survey (survey), *effect* a reduction (reduce), *execute* a search (search), *exert* an influence (influence), *exhibit* a performance (perform), *experience* a change (change), *give* an explanation (explain), *implement* a change (change), *make* a prediction (predict), *obtain* an increase (increase), *reach* a conclusion (conclude), *show* an improvement (improve), *subject to* examination (examine).

The above verbs in italics add no value for the reader. The OV below highlights the redundancy that such verb+noun constructions cause.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
In Figure 2 the curve *exhibits a downward trend* (portion A–B); then it *undergoes a rapid rise* (part B–C), it then *assumes a leveled state* (zone C–D). It *possesses a peak* at point E before displaying a slow decline … On the other hand, the curve in Fig 3 *is characterized by a different behavior*.	In Figure 2 the curve initially *falls* (segment A–B) and then *rises rapidly* (B–C). It then *levels off* (C–D). Finally it *peaks* at point E before falling slowly … On the other hand, the curve in Fig 3 *behaves* differently.

Note how in the RV the author uses verbs (*rises rapidly*), rather than a verb+noun construction (*undergoes a rapid rise*) – see Sect. 5.5.

Note that many nouns in English have a verb equivalent, including new coinages. So you can, for example, avoid saying *to send an email* or *to do a search on Google*, and simply say *to email* and *to google*.

5.6 Reduce the number of link words

While watching a film we unconsciously make hundreds of logical connections that enable us to follow the story line easily. We certainly don't think about the hours of film that have been cut out. Readers too make connections as they move from sentence to sentence, paragraph to paragraph. When papers reflect a clear, logical progression of ideas, the reader follows the argument without excessive promptings such as:

> *It is worthwhile noting that …,*
> *As a matter of fact …,*
> *Experience teaches us that …*

Compare the two versions below. Note how some of the link words from the OV have been removed in the RV, some have remained, and others have been added.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Our data highlighted a significant toxic effect. (1) *In fact,* cell survival in cultures inoculated with elutriates was about 75% of the control, respectively. (2) *Considering that* several heavy metals (HMs) are known to be carcinogenic compounds, the metal contamination may explain some of the toxicity. (3) *Moreover*, in complex mixtures, HMs may also act as co-mutagens, (4) increasing the toxic activity of other compounds (Brogdon, 2011). (5) *In particular,* cadmium could be responsible for the mutagenic effects. (6) *In addition,* the high concentrations of chromium may be responsible for the toxic effects, (7) *given that* chromium is a potent mutagenic compound (Ray, 1990) and it is also …	Our data highlighted a significant toxic effect. (1) *In fact,* cell survival in cultures inoculated with elutriates was about 75% of the control, respectively. (2) Several heavy metals (HMs) are known to be carcinogenic compounds, *thus* the metal contamination may explain some of the toxic results. (3) In complex mixtures, HMs may also act as co-mutagens, (4) *thus* increasing the toxic activity of other compounds (Brogdon, 2011). (5) Cadmium could be responsible for the mutagenic effects. (6) *In addition,* the high concentrations of chromium may be responsible for the toxic effects. (7) Chromium is *in fact* a potent mutagenic compound (Ray, 1990) and it is also …

Below is an analysis of the seven points indicated in the OV.

1. *In fact* is needed because it gives evidence of what was said in the previous sentence.
2. *considering that* forces the reader to wait till the second half of the sentence before understanding the meaning of the phrase. In the RV *considering that* has been replaced, later in the sentence, by *thus*. The resulting structure is: tell readers something then tell them the consequence.
3. *Moreover* is unnecessary as the sentence also contains the word *also* which has the same function as *moreover*.
4. In the RV *thus* has been added before *increasing*. This is absolutely necessary as the reader could interpret the sentence in a completely different way, i.e. that the way heavy metals act as co-mutagens is by increasing the toxic activity. For more on the difference between *thus* and *by* before an -ing form see Sect. 6.10.
5. In the OV, this is the fourth consecutive sentence that begins with a link word. Such a style of writing soon becomes repetitive and also delays the subject of the sentence. The expression *in particular* is rarely useful. In the RV it has been removed.
6. *In addition* is useful here as it alerts the reader that more is going to be said about the findings mentioned in the previous sentence, rather than this sentence moving on to a new topic.
7. In the RV, the OV sentence is terminated after *effects* and a new sentence is begun. In order to avoid the tedium of having link words always at the beginning of the sentence, *in fact* has been placed after the subject.

5.7 Choose the shortest words

If you have a choice of two words that mean the same thing, choose the shortest. However, if the short word is too informal, then don't use it. For example, *dear* and *cheap* are synonyms for *expensive* and *inexpensive* but they would not usually be

appropriate in a research paper. There is even a thesaurus, called Thsrs, which will find shorter synonyms for you!

SHORT	LONG	SHORT	LONG
advise, urge	recommend	now	currently
aim	objective	potential	potentiality
also	furthermore	show	demonstrate
but	however	spread	proliferation
end	termination (n), terminate (v)	thus	consequently
have	possess	use	utilization (n), utilize (v)
improve	ameliorate	usual	customary
keep	maintain	very	extremely
later	subsequently		

5.8 Choose the shortest expressions

Try to use the expression that requires the least characters.

X is large in comparison with Y. (26 characters)
X is larger than Y. (15 characters)

The following link words could be replaced by *since*:

considering that, given that, due to the fact that, on the basis of the fact that, notwithstanding the fact that, in view of the fact that, in consequence of the fact that

Occasionally, you may want to draw the reader's attention to an important point. You will do this more effectively if you use two words rather than ten. This will produce a short sentence. Short sentences tend to stand out from the rest of the text, and thus get noted more.

All the phrases below could be replaced by *Note that …*

It must be emphasized / stressed / noted / remarked / underlined …
It is interesting to observe that …
It is worthwhile bearing in mind / noting / mentioning that …
It is important to recall that …
As the reader will no doubt be aware …
We have to point out that …

5.9 Use the shortest adverbial expression

Instead of using an adjective + a generic noun (*way, mode, fashion*), use the adverb form of the adjective.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
To do this, the application searches for solutions *in an automatic way / fashion / mode.*	To do this, the application searches for solutions *automatically.*
This should be avoided since *it is generally the case that* it will fail.	This should be avoided since it *generally* fails.
From a financial standpoint, it makes more sense to …	Financially, it makes more sense to …

Other examples: in the normal course of events (normally), on many occasions (often), a good number of times (many times, frequently), from time to time (occasionally), in a rapid manner (rapidly), in a manual mode (manually), in an easy fashion (easily), from a conceptual point of view (conceptually).

For rules on the position of adverbs see Sect. 2.12.

5.10 Avoid pointless introductory phrases

Often you can avoid an introductory phrase when it is preceded by a heading. For example, immediately after a heading entitled Results, the following phrases would be completely redundant.

> The salient results are summarized in the following.
> The results of this work may be synthesized as follows.
> Let us recapitulate some of the results obtained in this study.

Likewise, it is pointless immediately under a heading entitled Conclusions to begin by saying:

> In conclusion, we can say that …

5.11 Avoid impersonal expressions

Impersonal expressions are those that begin a sentence with *it is* … Such expressions tend to delay the subject (Sect. 2.5) You can replace impersonal expressions by:

(a) using modal verbs (*can, must* etc.).

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
It is necessary / mandatory to use X.	X *must* be used. X is necessary / mandatory.
It is advisable to clean the recipients.	The recipients *should* be cleaned.
It is possible that inflation will rise.	Inflation *may* rise.

(b) using adverbs (*surprisingly, likely* etc.). For the position of adverbs in a sentence see Sect. 2.12.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
It is surprising that no research has been carried out in this area before.	*Surprisingly*, no research has been carried out in this area before.
It is regretted that no funds will be available for the next academic year.	*Unfortunately*, no funds will be available for the next academic year.
It is clear / evident / probable that inflation will rise.	Inflation will *clearly / probably* rise.

(c) rearranging the sentence

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
It is possible to demonstrate [Kim 1992] that …	Kim [1992] *demonstrated* that …
It is anticipated / believed that there will be a rise in stock prices.	We *expect* a rise in stock prices. We *believe* there will be a rise in stock prices. A rise in stock prices *is expected.*
It may be noticed that … *It is possible to observe* that …	*Note* that …

However, impersonal phrases may be useful when you want to hedge your claims (Sect. 9.9).

5.12 Reduce your authorial voice

Readers will not appreciate being continually given a commentary on what you are doing in your paper, as in the first five examples below. It is also unnecessary to use *we* to refer to you and your readers, as in the last example.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
As in the previous case we observe that there are three distributions of this measure:	There are three distributions of this measure:
We can identify two categories of users ..	There are two categories of users ..
Thus, in this analysis we decided to focus our attention on ..	This analysis focuses on …
It is now time to turn our attention, in the rest of the paper, on the question of ..	The rest of the paper focuses on the question of …
We find it interesting to note that x = y.	Interestingly, x = y.
As we can see in Fig. 1, for each network we have a series of different relationships.	Figure 1 highlights that there is a series of different relationships for each network.

For more on this topic see Sect. 7.5.

5.13 Be concise when referring to figures and tables

The RVs below highlight how it is not difficult to be concise when referring to figures and tables.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Figure 1 shows schematically / gives a graphical representation of / diagrammatically presents / pictorially gives a comparison of two components	Figure 1 shows a comparison of two components.
From the graphic / picture / diagram / drawing / chart / illustration / sketch / plot / scheme that is depicted / displayed / detailed / represented / sketched in Figure 3, we can say that …	Figure 3 shows / highlights / reports that …
The mass spectrum, reproduced in the drawing in Figure 14, proved that …	The mass spectrum (Fig. 14) proved that …
We can observe / As can be seen from Table 3 that …	Table 3 highlights that …
From an analysis / inspection of Table 3 it emerges that …	

If you refer your readers to a figure, you don't need to describe the figure using words like *graphically* or *schematically*. You don't need to use many different synonyms either to describe what kind of figure it is or to say what it shows. If possible use active verbs – *this figures shows x*, rather than *x is shown in this figure*.

In your text, avoid duplicating information that can be easily found in tables and figures. Just give the highlights (Sect. 16.9).

5.14 Use the infinitive when expressing an aim

You can often save space by expressing your purposes and objectives in the shortest form possible.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
We use X *for the purposes of showing* the suitability of Y for the description of Z.	We use X *to show* how Y is suitable for describing Z.
In order to maximize channel utilization …	*To maximize* channel utilization …
The design of software is aimed at supporting *multimedia services.*	The software is designed *to support* multimedia services.
	The software *supports* multimedia services.

For more on this topic see Sect. 15.10.

5.15 Redundancy versus Conciseness: an example

Being concise is important not just in reducing number or words and potential mistakes, but also in increasing readability and impact.

Read the following two versions of the beginning of an abstract, and then look at the analysis that follows.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
ICT *technologies are expected to* hold the *ignition* key to the reduction of the greenhouse gases *produced worldwide, which is a non-debatable global priority.* The importance of "greening of the Internet", therefore, is *recognized as* a primary design goal of the future global network infrastructures. *Indeed*, the Internet *today* already accounts for about 2% of the total world energy consumption, but with the current trend of shifting offline services online, this percentage will grow significantly *in the next few years*, and it will be pushed further by *the forthcoming* Internet-based platforms that require always-on connectivity. *In this paper* we present … (101 words)	ICTs hold the key to *reducing* greenhouse gases. Greening the Internet is a primary design goal of future global network infrastructures. The Internet already accounts for about 2% of total world energy consumption and *now that offline services are being shifted online*. This percentage will grow significantly and will be further fuelled by the forthcoming Internet-based platforms that require always-on connectivity. We present … (64 words)

technologies - ICT stands for 'Information and Communications Technology', thus *technologies* is redundant and ICT should be made plural (ICTs).

ignition keys - *ignition* adds no extra information.

produced worldwide - unless the author states that the gases are only produced in one particular location, then it is clear to the reader that this is a worldwide phenomenon.

which is a non-debatable global priority - this is firmly established information that all readers will be aware of (whether they agree with it or not).

recognized as - recognized by who? Presumably by the scientific (and political) community. This information is implicit and is therefore probably not necessary.

indeed - this is an example of a link word that adds no extra information and if the paragraph is structured correctly, such link words may be redundant.

today - unless stated otherwise it is clear that the time reference is now so *today* is unnecessary.

in the next few years and *the forthcoming* - the use of *will* clearly indicates that this is a future event, and given that readers are likely to be ICT people they will already know the time-scale. In any case, if the action was not in the very near future presumably the author would have used a more accurate indication (e.g. *in 10–15 years*).

in this paper - given that this is part of an Abstract, the reader knows that the text refers to the associated paper.

The RV also makes use of other tricks to make the OV more concise, again these are indicated in italics.

key to the reduction of becomes *key to reducing* - this is an example of using use a verb instead of a noun (Sect. 5.4). In this case the verb is in the *-ing* form because it comes after a preposition (*key* + *to* + *-ing*).

but with the current trend of shifting offline services online becomes *now that offline services are being shifted online* - this change is not strictly necessary, but the present continuous already contains the idea of a current trend.

The abstract could also be restructured as follows:

> The Internet accounts for about 2% of total world energy consumption and ICTs hold the key to reducing this aspect of greenhouse gases. Now that offline services are being shifted online, this percentage will grow significantly and will be further fuelled by the forthcoming Internet-based platforms that require always-on connectivity. Greening the Internet is thus a primary design goal of future global network infrastructures. We present …

The revised version is no less 'elegant' or 'scientific' than the original version. However, there is a 30% loss of redundancy (61 vs. 104 words), which translates into:

- a 30% increase in readability - I have yet to read a referee's report that complained that the English was too simple or too easy to read!
- 30% less chance for making mistakes in English - clearly the less you write the fewer potential mistakes you can make
- 30% more space available for you to give the reader useful information
- 30% less paper, ink and energy used - not only do we need to 'green' the Internet, we need to 'green' our writing too!

It takes more than three hours to read 30,000 characters. If you reduce the paper by 30% you will spend one hour less reading / revising it.

If you have your paper corrected by a science editor, the cost will strictly depend on the number of words. So, if you write less it will cost you less to have the paper revised.

If you use 30% fewer words it will take up to 30% less time to revise and proofread. The first few times you attempt to write in a concise way, it will probably take you longer because you have to think more. But when writing concisely becomes a habit, it will certainly take you less time.

5.16 Constantly ask yourself - does what I am writing add value for the reader?

A problem that all authors experience, particularly those writing outside the pure sciences, is falling into the trap of writing things that give them satisfaction or pleasure when they re-read them, but which in reality have no benefit for the reader. A really useful skill in writing is thus to be critical of your own work. Try to play at being the editor of your work and use your red pen to delete anything that is not strictly relevant for the reader. As English writer Samuel Johnson said: "Read over your compositions, and wherever you meet with a passage which you think is particularly fine, strike it out."

5.17 Summary

You can be more concise by:

- deleting any words that are not 100% necessary
- finding ways of expressing the same concept with fewer words
- using verbs rather than nouns
- choosing the shortest words and expressions
- avoiding impersonal phrases that begin *it is* …

A frequent result of reducing the overall number of words is that the subject of the sentence tends to be shifted closer to the beginning of the sentence. This means that the reader gets a much quicker picture of the topic of the sentence. Also, if you use the minimum number of words the importance of what you are saying will stand out more clearly for the reader.

These rules in this chapter are designed to help you write in a more concise way. However it is also important to vary the way you write. It is perfectly acceptable to write a long phrase or sentence, or a complicated construction, provided that you only do this occasionally.

Finally, note that on some occasions, conciseness can produce unintelligible phrases (Sect. 2.15). It is always better to put clarity first, even if it means having to use more words.

Chapter 6
Avoiding Ambiguity and Vagueness

Why is this chapter important?

A sentence or phrase is ambiguous or vague when it has more than one interpretation or its interpretation is not obvious. If referees are not clear about what you are saying in a particular sentence, this may affect their overall understanding of the contribution of the paper. They may thus feel that they are not in a position to judge the merits of your paper. Just two or three ambiguous sentences are enough for referees to recommend delaying publication until 'the English has been revised by a native speaking expert'.

Of course, it is not possible (or necessarily even desirable) to eliminate all possible sources of ambiguity. It would also lead to immensely long documents written in the style of lawyers. Sometimes it is perfectly acceptable if a particular phrase or word is open to interpretation, provided this does not interfere with the reader's overall understanding. For example, does the word *avoiding* in the title of this chapter refer just to *ambiguity* or to *vagueness* too? It is fairly obvious that it refers to both, so I didn't spend time in trying to clarify it. Other times you may deliberately wish to be vague, e.g. when you yourself are unclear about the meaning of your findings.

However there are some typical grammar mistakes made in research papers that often give rise to confusion in the mind of the reader and thus lower the level of readability. Such mistakes are the topic of this chapter, along with some warnings about misleading punctuation and vague language. If you try to reduce the number of these types of mistakes, you will increase the chances of your manuscript being accepted in your chosen journal.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_6, © Springer Science+Business Media, LLC 2011

What the experts say

I have revised several hundred research papers in the course of my career as a language consultant. Ambiguity as a cause for misunderstanding by readers is often underestimated by non-native researchers. This is often because they mentally translate what is a clear and precise sentence in the syntax of their own language into a potentially ambiguous sentence in English.

Chris Powell, Director of International House, Pisa, Italy

A key skill for an editor is to spot sentences that might be open to different interpretations. Editing these sentences in order to remove the ambiguity and to increase precision is generally not too difficult. Although spotting and resolving ambiguity in the work of others is relatively easy, spotting it in your own work is considerably more difficult - but in scientific works it is essential.

Mark Worden, editor Speak Up, and author

As a writer of textbooks for non-native speakers of English, I constantly strive to give students the clearest possible instructions to any exercises I ask them to do. If I fail to do this, students and teachers will waste valuable time trying to interpret the instructions, and thus become frustrated. Removing ambiguity is a crucial part of this process.

Keith Harding, EFL author and language trainer

6.1 *which / who* vs. *that*

In scientific English, *which* and *that* have distinct uses. For example, imagine you are instructed to do the following:

S1. *Correct the sentences below which contain grammatical mistakes.

Does S1 mean (i) that all the sentences contain grammatical mistakes, or (ii) that you should correct only those sentences that contain mistakes? If all the sentences contain mistakes, S1 should be rewritten as S2. If only some sentences contain mistakes, S1 should be rewritten as S3.

S2. Correct the sentences *below, which* contain grammatical mistakes.

S3. Correct the sentences *below that* contain grammatical mistakes.

The rule is that if you are simply adding extra information (S2) then use *which* (things) or *who* (people) preceded by a comma (,). If you are defining the previous noun then use *that*. Given that not many people are aware of this distinction, it is probably better to rewrite the sentences more explicitly. Thus S2 and S3, become S4 and S5, respectively.

S4. Correct the sentences *below, all of which* contain grammatical mistakes.

S5. Correct *only those sentences below that* contain grammatical mistakes.

Here is an example using *who* and *that*, which should help to clarify the difference between adding extra information (S6) and making a definition (S7).

S6. My sister**,** *who* lives in Paris**,** is a researcher.

S7. My sister *that* lives in Paris is a researcher.

In S6 the information contained between the two commas is not essential. S6 tells the reader that I have only one sister and she is a researcher - the fact that she lives in Paris is just additional information. I could simply say: *My sister is a researcher*.

But in S7 I am giving very different information. I am telling you that I have more than one sister, and that the sister that lives in Paris is a researcher. Perhaps my other sister is a doctor and I am using Paris to distinguish between my two sisters.

S2 and S6 are grammatically known as non-defining clauses. In a non-defining relative clause you add extra information. You could remove the clause and the resulting sentence would still make sense. In non-defining clauses *which* (for things) and *who* (for people) are used.

S3 and S7 are examples of defining clauses, also known as restrictive clauses. They give essential information without which the sentence would make no sense. In defining clauses, only *that* can be used.

A similar problem arises when the author does not use either *which* or *that*, as in S8. S8 would not be considered correct English by most language experts.

S8. *This is followed by a characterization of the states *poorly represented* at atmospheric pressure.

S8 can be disambiguated as in S9 (non-defining) and S10 (defining).

S9. This is followed by a characterization of the states, *which are* poorly represented at atmospheric pressure.

S10. This is followed by a characterization of *all those states that are* poorly represented at atmospheric pressure.

Note: In spoken English, people do not usually make such a distinction and may simply use *which* for things, and *who* for people, irrespectively of whether they are using defining or non defining clauses.

6.2 *which, that* and *who*

which, that and *who* should only refer to the noun that immediately precedes them.

S1. *A group of patients was compiled using this procedure, as proposed by Smith and Jones [2010], *who* had died under surgery.

An initial reading of S1 gives the impression that Smith and Jones died under surgery! This ambiguity arises because the subject (*patients*) has been separated from its verb (*had died*) by a subordinate clause (*as proposed* ...). The solution is to keep the subject and verb as close as possible to each other.

S2. A group of patients *who* had died under surgery was compiled using this procedure, as proposed by Smith and Jones [2010].

Here is a similar example (S3), which is less dramatic and less open to ambiguity but could be rewritten more clearly (S4):

S3. Each scheduling service is characterized by a mandatory set of QoS parameters, as reported in Table 1, *which* describes the guarantees of the applications.

S4. Each scheduling service is characterized by a mandatory *set* of QoS parameters, as reported in *Table 1. This set* describes the guarantees of the applications.

In this case, the solution (S4) is to split the sentence in two and repeat the key word (*set*).

6.3 *-ing* form vs. *that*

Authors sometimes use the *-ing* form in what is effectively a relative clause (i.e. a clause that begins with *that, which* or *who* - see Sect. 6.1). This usage is acceptable in phrases such as:

S1. Those students *wishing* to participate in the call for papers should contact ...

S2. The professor *giving* the keynote speech at the conference is from Togo.

S1 could be rewritten as *students that / who wish*, and S2 the professor *that / who is giving*. However, there is no possible ambiguity because the *-ing* form comes immediately after the noun it refers to.

However, in S3 it is not clear who has the good level of English: the students or Prof. Rossi.

S3. * Professor Rossi teaches the students *having* a good level of English.

S4 clarifies that it is the students that have good English. In S5 Prof. Rossi is the subject of both verbs (*teach, have*), so in this case we need to change the structure of the sentence and use *since, because* or something similar.

S4. Professor Rossi teaches the students *that have* a good level of English.

S5. Professor Rossi teaches the students *since he has* a good level of English.

6.4 - *ing* form vs. subject + verb

In clear unambiguous writing, verbs should be immediately preceded by their subject.

S1. * If you take your young daughter in the car, don't let her put her head out of the window *while driving.*

S2. **After consuming* twenty bottles of wine, the conference chair presented the awards to the fifty best PhD students.

In S1 it initially seems that *driving* refers to the young daughter. This is because the person located in the phrase nearest to the word *driving* is the girl not *you*. In S2 it seems like conference chairperson consumed 20 bottles of wine, whereas presumably it was the students who did the drinking. The sentences should thus be rewritten:

S3. If you take your young daughter in the car, don't let her put her head out of the window *while you are driving.*

S4. After the fifty best PhD *students had consumed* twenty bottles of wine, the conference chair presented them with the awards.

In S3 and S4 the *-ing* form has been replaced with an active form of the verb (*are driving, had consumed*) preceded by the subject (*you, students*). If you use an active form you will be forced to use a subject and this will make your writing clearer.

In S5 below there is an initial ambiguity as the order of words makes it seems that psocoptera read books! (*Psocoptera* are an order of wingless insects that attack paper).

S5. * We cannot understand how *psocoptera survive by reading books* alone. Instead we need to ...

If we rephrase the sentence by putting the *-ing* form at the beginning, the true meaning is a little clearer:

S6. *By reading books* alone, we cannot understand how psocoptera survive. Instead we need to ...

However the clearest way is to avoid the *-ing* form completely and replace it with a subject + verb construction:

S7. *If we only read books*, we cannot understand how psocoptera survive. Instead we need to …

So, beginning a sentence with the *-ing* form can be dangerous, because the reader doesn't know who or what is carrying out the activity introduced by the *-ing* form.

S8. **By sitting and watching* too much television, our muscles become weaker.

In S8, it initially seems that the muscles are watching television, though this is clearly absurd. The solution is to put a subject (*we*) in front of the verb, as in S9.

S9. When *we sit and watch* too much television, our muscles become weaker.

6.5 *- ing form* with *by* and *thus*

Look at the ambiguous sentence below.

S1. * This will improve performance *keeping* clients satisfied.

Does S1 mean: (a) the way to improve performance is if clients are kept satisfied? or (b) as a consequence of improving performance clients will be satisfied?

We can show the true meaning if, before the *–ing* form, we insert *thus* or *by*:

S2. This will improve performance *thus keeping* clients satisfied.

S3. This will improve performance *by keeping* clients satisfied.

S2 means that if clients are satisfied, performance will improve – *thus* means *as a consequence*. In S3 client satisfaction depends on performance – *by* indicates how something is done.

Often it is a good idea simply to break up the sentence or use *and*. An alternative to S3:

S4. This will improve performance *and* clients will (*thus*) be satisfied.

S5 is another ambiguous sentence. It can be disambiguated as in S6 and S7, both of which have the same meaning.

S5. * The Euro indirectly raised prices, *causing* inflation.

S6. … raised prices. This *consequently / subsequently caused* inflation.

S7. … raised prices *and so / thus caused* inflation.

It is best to replace the *–ing* form with *and* when you are simply giving additional information. Thus S9 is clearer than S8.

S8. *This section focuses on the reasons for selecting these parameters, *trying* to explain the background to these choices.

S9. This document focuses on the reasons for selecting these parameters, *and tries* to explain the background to these choices.

Finally, note the difference between these three sentences.

S10. *To burn* CDs you just need some software.

S11. *Burning* CDs now takes only a few seconds.

S12. *By burning* CDs we deprive artists of royalties.

The infinitive (S10) means *If you want to / If your aim is to …*

The *-ing* form with no preceding preposition (S11) refers to the activity of burning CDs, it acts as the subject of the sentence. S12 means *If we burn CDs we will deprive artists of royalties.*

6.6 *a, one* and *the*

This subsection deals with the definite article (*the*), the indefinite article (*a/an*), and the difference between *a / an* and *one* (*one* is a number, like *two* and *three*. It is not an article).

The usage of articles in the French version (another official language of the UN) seemed to imply all the territories, whereas the English version, with no use of the definite article, could be interpreted as some territories but not necessarily all.

Fortunately in scientific English, Mistakes with article do not usually have serious consequences. For example:

S1. *The ambiguity is one characteristic of English language.

S1 is very poor English, but the meaning is clear enough. A better version would be:

S2. Ambiguity is a characteristic of the English language.

There are three mistakes in S1.

(1) General (no article) vs. specific (article must be used)

We are talking about *ambiguity* in general, so we don't need the definite article. But we would say *the ambiguity of English*, because in this case we are talking about something specific. A good general rule here is that if you have the sequence - Noun A + *of* + Noun B - then Noun A is preceded by *the*.

(2) *A / An* (indefinite article) vs. *one* (number)

We might say *one characteristic* if we were then going to enumerate other characteristics, but in this sentence the main topic is ambiguity and not the number of characteristics.

(3) Languages

We say *the English language*, though we could equally say *English.* If we say *the English* we refer to the people and not the language.

S1 and S2 highlight some of the complexity of the use of English articles, but in this particular case none of the mistakes are likely to interfere with the reader's understanding.

However, the general versus specific rule can cause problems.

S3. *A researcher* spends many days in the lab.
S4. *Researchers* spend many days in the lab.
S5. *The researcher* spends many days in the lab.
S6. *The researchers* spend many days in the lab.

In S3 we are talking about a generic researcher, who we have not mentioned before. S4 has the same meaning as S3, it means 'all researchers', so the non use of *the* is correct. S5 indicates that the researcher has already been mentioned before and that the reader knows which researcher we are talking about. The same is true of S6, though this time we are talking about more than one researcher. If S5 or S6 appeared at the beginning of a new section in a paper, the reader might be confused and would be forced to look back to earlier sections to see if he / she could find a previous reference to the researcher/s. So always remember that if you use *the* with a countable noun it implies that you have already mentioned this noun before.

The *a* versus *one* rule can also be problematic.

S7. We made *one* experiment before the equipment exploded.
S8. We made *an* experiment before the equipment exploded.

In S7 we imply that we had planned a series of experiments (at least two), but that these were interrupted by the explosion. In S8 no such series is implied. The two sentences thus have very different meanings.

For more on the definite and indefinite article see Sect. 11.14.

6.7 Uncountable nouns

A countable noun is something you can count - *one apple, two apples*. An uncountable noun is something that, at least in English, you cannot count. You cannot say *an information, these informations* etc. *Information* is considered a mass, and for English speakers it is not easily split into different parts.

Spinach leaves can be clearly separated and counted, but when cooked they become one big mass. You cannot clearly and easily identify cooked spinach as separate parts - so you cannot say *these spinaches taste very good*, but only *this spinach tastes very good*. Similarly, you can count *cars* but not *traffic*, *steps forward* but not *progress*, *comments* but not *feedback*.

These kinds of subtleties do not normally cause problems. But when an uncountable noun is referred to in a later phrase with a plural pronoun (*they, these, those*) or adjective (*many, few*) it can create confusion for readers.

S1. * Such *feedbacks are* vital when analyzing the queries. At subsequent stages in the procedure, for instance after steps 3 and 4, *they* are also useful for assessing …

S2. * Such *feedbacks are* vital when analyzing the queries. At subsequent stages in the procedure, for instance after steps 3 and 4, *many of them* are also useful for assessing …

Note: *feedback* is uncountable, so it has no plural form. S1 and S2 are thus not correct English.

In S1, a native speaker would think that *they* must refer to *queries*, since *queries* is plural. In S2, the reader would be totally confused and would probably be unable to understand what *many of them* refers to. Possible revised versions of S1 and S2 are:

S3. Such *feedback is* vital when … At subsequent stages *it is* also useful for …

S4. Such *feedback is* vital when … At subsequent stages *much of it is* also useful for …

Pronouns are in any case a constant source of ambiguity in English, so the best solution is to repeat the noun that the pronoun refers to.

S5. Such *feedback is* vital when … At subsequent stages *(a lot of) this feedback is* also …

6.8 Pronouns

Some sentences that would not be ambiguous in your language may become ambiguous in English. For example:

S1. *I put the book in the car and then I left *it* there all day.

In English we do not know whether *it* refers to the *book* or the *car*. Some languages have a case system or a gender for nouns. Thus if your word for *book* is - for instance – masculine, and your word for *car* is feminine, you will use a different form of *it* to indicate whether the noun *it* refers to is masculine or feminine, and this will make it clear for your reader. In English *it* can refer to all nouns (apart from those that refer to human beings).

In any case, if you use *it* in one sentence to refer to a noun you have mentioned in a previous sentence, you may be forcing to the reader to re-read the previous sentence to remember what *it* refers to. So if you think that there could be possible ambiguity or that the reader may have forgotten the subject, then simply repeat the key word:

S2. I put the book in the car and then I left *the book* there all day.

You may think this is not very elegant, but it is much clearer for your reader and is not considered bad style in technical English.

In S3 does *they* refer to all three locations, to Canada and the Netherlands, or just to the Canaries?

S3. *We could go to Australia, Canada or the Netherlands, *but they* are a long way from here.

To avoid misunderstandings, be more specific:

S4. Australia, Canada or the Netherlands, *all of which* are a long way from here.

S5. Australia, Canada or the Netherlands. *But Canada and the Netherlands* are a long way from here.

S6. Australia, Canada or the Netherlands. *But the Netherlands* are a long way from here.

In S7 what do *one* / *this* / *these* refer to? (a) user names (b) passwords?

S7. *No user names or passwords are required, unless the system administrator decides that *one* is necessary. … decides that *this* is necessary. … decides that *these* are necessary.

Interpretations (a) and (b) are much clearer rewritten as in S8 and S9, respectively.

S8. … unless the system administrator decides that a *user name* is necessary.

S9. … unless the system administrator decides that a *password* is necessary.

In S10 and S11 what do *this* and *them* refer to?

S10. *There are two ways to learn a language: take private lessons or learn it in the country where the language is spoken but *this* entails spending a lot of money.

S11. *We cut the trees into sectors, then separated the logs from the branches, and then burnt *them*.

Does *this* in S10 refer to the cost of private lessons, the cost of living in the country where the language is spoken, or both? Does *them* in S11 refer to just the branches or the logs as well? To clarify, you just need to repeat the key concept.

S12. There are two ways to learn a language: take private lessons or learn it in the country where the language is spoken. However *living in a foreign country* entails spending a lot of money.

S13. There are two ways to learn a language: take private lessons or learn it in the country where the language is spoken. However *both these solutions* entail spending a lot of money.

In S12 it is now clear the cost only refers to living in a foreign country, and S13 clarifies that lessons plus living in a foreign country have a high cost. In S13, *solutions* has been used to replace *ways* in the first part of the sentence – using synonyms for non-key words is fine.

To clarify S11, you just need to replace *them* with *branches* (if it is just the branches that were burnt), or with *both of them* (if both branches and logs were burnt).

6.9 Referring backwards: *the former, the latter*

When you refer back to something you mentioned before, it is often not immediately clear what *the former* and *the latter* refer to.

S1. * Africa has a greater population than the combined populations of Russia, Canada and the United States. In *the latter* the population is only …

In S1 does *the latter* refer just to the US alone, or to the US and Canada? The simplest and clearest solution is to replace *the latter* with the exact word or words it refers to. This gives:

S2. Africa has a greater population than the combined populations of Russia, Canada and the United States. In *the USA* the population is only …

S3. Africa has a greater population than the combined populations of Russia, Canada and the United States. In *Canada and the USA* the population is only …

It is not a problem to repeat words if the result is that the reader will be clear about what you want to say. This is particular true if the word that *the former / the latter* refers to is some distance away. For example:

S4. **Smith* was the first to introduce the concept of readability in websites. In his seminal paper, written in 1991, he realized that the way we read pages on the web is totally different from the way we read a printed document. Five years later, Jones studied the differences between the way that people of different languages, whose scripts are written left right (e.g. English), right left (e.g. Arabic) and top down (e.g. Japanese), read texts on the web. *The former author* then wrote another paper …

By saying *the former author* you are forcing the reader to go back four or five lines in order to remember which author you are talking about. By simply saying *Smith then wrote* you save the reader time and frustration.

Clearly there are some occasions when using *the former* and *the latter* is OK because there is no possible ambiguity:

S5. Water organisms can be contaminated directly or indirectly. The *former* occurs by contact or ingestion of the substance dissolved in water, whereas the *latter* happens when the contaminant is accumulated in the food chain.

In S5 there is no ambiguity, but in any case S6 would still be clearer for the reader and would have more impact:

S6. Water organisms can be contaminated directly or indirectly. *Direct contamination* occurs by contact or ingestion of the substance dissolved in water, whereas *indirect contamination* happens when the contaminant is accumulated in the food chain.

Specific words (*contamination*) are more readily absorbed and memorable than generic words (*the former*).

The problem with ambiguity in back-referencing is not just with *the former* and *the latter*. What does *Concerning this last topic* refer to in S7?

S7. * In recent years, these skills have been applied to the study of heavy metal accumulation *and* toxicity in mammalian cells *and* the modulation of neurotransmitter-gated ion channels by metal ions in primary neuronal cultures *and* in recombinant receptors expressed in heterologous systems. *Concerning this last topic*, there has been much interest in …

The problem is that the use of *and* three times makes it initially hard for the reader to divide up the sentence into different topics. Maybe *this last topic refers* exclusively to *recombinant receptors*. However, it might refer to *modulation of neurotransmitter-gated ion channels* and *recombinant receptors*. By simply repeating the topic, as in S8, the reader can immediately understand what the writer is referring to.

S8. … and in recombinant receptors expressed in heterologous systems. *With regard to such recombinant receptors*, there has been much interest in …

6.10 *above* and *below*

When making reference to things that are mentioned earlier or later in your documents, it is best not use *above* and *below* in isolation.

S1. * As mentioned *above / before*, these values are important when …

S2. * These points are dealt with in detail *below* …

If readers are interested in these things, then they need an exact location, for example: s*ee Sect. 1.1 / see the above paragraph / see points 4–5 below.* However, it is acceptable to say *as mentioned above* or *as mentioned before* when you don't want the reader to go back to what you said before, but simply to reassure them that you are aware that you are saying the same thing again.

6.11 Use of *respectively* to disambiguate

Respectively is a very useful word for clarifying how items are related to each other. In S1, a basic knowledge of geography makes it clear that London is associated with England, and Paris with France.

S1. London and Paris are the capitals of England and France.

But such connections are not always so obvious, as in S2:

S2. *… where X is the function for Y, and f1 and f2 are the constant functions for P and Q.

Are f1 and f2 constant functions for both P and Q? If so:

S3. … and f1 and f2 are the constant functions for *both* P and Q.

Or is f1 for P and f2 for Q? If so, use *respectively*:

S4. … and f1 and f2 are the constant functions for P and Q*, respectively*.

Most style books recommend placing *respectively* at the end of the phrase. It is best to put a comma before *respectively*.

6.12 *and*

Legal battles have been fought over the usage of *and*. For example, suppose a research institute promises to 'pay you €10,000 and give you a full contract if you finish the research within 18 months'. What happens if you don't finish within 18 months? Do you still get the €10,000? Well you would only get the money if there was a comma before the *and* because the comma would indicate that the €10,000 and the finishing of the research are two different issues.

Commas in modern English are used to make meaning clearer.

Here is another example, this time from an email:

S1. * I will be free the whole of Monday *and* Tuesday *and* Thursday morning unless one of the professors decides to arrange an extra class.

Does this mean that she will be free (a) all Monday and Tuesday, or (b) all Monday and also Tuesday and Thursday mornings? If it is case (a), then the sentence would be better rewritten as S2, and case (b) as S3:

S2. I will be free the whole of Monday, *and* (also) Tuesday and Thursday morning.

S3. I will be free the whole of Monday and Tuesday, *and* (also) Thursday morning.

Most languages, including English, have a rule that you cannot put a comma before *and*. This rule has been abandoned by the majority of English writers as too often it can cause ambiguity.

If you have lists of items, you need to show how the various items relate to each other. In such cases semicolons can be useful, as in S4.

S4. The languages were grouped as follows: Spanish, Italian and Romanian; German and Dutch; and Swedish and Norwegian.

6.13 *both … and, either … or*

both … and is inclusive. *either … or* is exclusive.

S1. We studied both English and Spanish.

S2. You can study either English or Spanish.

S1 means that we studied English and we studied Spanish. S2 means that you can only study one language. You cannot study English and Spanish. You can study English or you can study Spanish.

S3. You cannot study both Russian and Korean.

S4. You cannot study either Russian or Korean.

S3 means that you have to choose between Russian and Korean. You can only study one of the two languages. S4 means that these two languages are not offered. Neither of them can be studied.

The position of *both* can change the meaning. Note the difference between these two sentences:

S5. This is true both for the students and the professors.

S6. This is true for both the students and the professors.

In S5 there are several students (and professors) involved, in S6 there are only two students and an undefined number of professors.

In S7 just two parks are being referred to, whereas in S8 there is an unknown number of parks.

S7. We had fun in both the parks we visited and also the museums.

S8. We had fun both in the parks and the museums.

6.14 False friends

False friends are words from two different languages that look very similar but have different meanings. The most common of these is *actually*, which in English means *in reality*, but its false friend in other languages means *at the moment*. Another one, which frequently appears in research, is to *control* whose false friend in many other languages means to *verify*. Here is the difference:

S1. A thermostat is used to *control* the temperature.

S2. We *checked* the patient's temperature with a thermometer.

In S1 *control* means to regulate, whereas in S2 to *check* means to make a verification without altering anything. In 1905 this particular false friend nearly caused a treaty between Russia and Japan to fall apart. The draft of the treaty was written in English and French, and *control* and *contrôler* were both attributed the same meaning, whereas the English word meant 'dominate' and the French word 'inspect'.

In scientific papers, false friends rarely cause problems.

6.15 Latin words - *i.e.* versus *e.g.*

The problem with many Latin expressions is that you may know what they mean, but your reader may not. In the examples below *i.e.* (used for defining) and *e.g.* (for giving examples) are not interchangeable.

S1. Great Britain, *i.e.* England, Scotland and Wales, is the ninth biggest island in the world and the third most populated.

S2. Some EU members, *e.g.* Spain, Italy and France, are not in agreement with this policy.

In S1 *i.e.* is used to define Great Britain, which contains only those three countries.

In S2 *e.g.* means that Spain, Italy and France are just some examples of countries in the European Union who do not agree with the policy - but the implication is that there are other countries involved as well.

If you are not short of space then it is generally better to use alternative versions. Another way to say *i.e.* is *that is to say*. Other ways to say *e.g.* are: *for example, such as,* and *for instance*.

Unless they are commonly used in your chosen journal, try to avoid other Latin expressions such as *a priori, a posteriori, ex ante, in itinere, ex-post, ceteris paribus* and others. Some readers, including native English speakers, may not know what they mean. Thus S3 would be better rewritten as S4:

S3. This argument holds, *a fortiori*, in mergers, where the reduction of the number of firms in the market is an explicit objective.

S4. This argument holds *for similar but even more convincing reasons* in mergers, where the reduction of the number of firms in the market is an explicit objective.

If you use Latin expressions, check with your journal whether they should be in italics or not.

6.16 Monologophobia - the constant search for synonyms

When you were at school learning your own language, your teachers probably encouraged you not to use the same word in the same sentence more than once, and maybe not even in the same paragraph. Finding synonyms was good. Consequently, like many researchers you probably now suffer from monologophobia – the fear of using the same word twice!

Monologophobia can cause ambiguity or confusion for the reader. For example, do the three words in bold in S1 have a different meaning?

S1. **Companies* have to pay many taxes. In fact, occasionally *enterprises* fail because of over-taxation. Some *firms* resolve this problem by moving their headquarters to countries where the tax rate is lower.

For the author, they probably have the same meaning, but not necessarily for the reader. The reader cannot be sure and may try to work out what the difference between the three terms is. The author is thus forcing the reader to make an unnecessary mental effort.

If you decide to use words that have similar meanings but each in a specific way, then you should define these differences for the reader. In S1 you would need to define the difference between a company, an enterprise and a firm.

A very important rule in scientific English is: never find synonyms for key words - avoid synonymomania!

S1 could thus be rewritten as S2.

S2. *Companies* have to pay many taxes and occasionally may fail because of over-taxation. Some [*companies*] resolve this problem by moving their headquarters to countries where the tax rate is lower.

Authors come up with a lot of solutions for not repeating the same word. One device is to replace the key word with a generic description of it.

S3. *Our findings demonstrate that treatment with *chitosan* resulted in the significant protection of Arabidopsis leaves against the necrotrophic fungus Botrytis cinerea. This is closely related to the fact that this *compound* is perceived by the plant as a powerful elicitor.

S4. *The maximum solubility of *mercury* occurs in an oxygenated environment, which is the typical condition found in soil. The principle forms that are found in soil are $Hg(OH)_2$ and $HgCl_2$. With these ions, this *metal* can form soluble complexes that are …

Readers will probably understand that in S3 *compound* refers to *chitosan*, and in S4 that *metal* refers to *mercury*. But it will help readers if you repeat the word for them (*to the fact that chitosan is perceived, … these ions, mercury can form*), so that they don't have to read backwards to check. This is particularly important when the generic word (*compound, metal*) appears several lines later than the original concrete word (*chitosan, mercury*).

Another typical device to avoid repetition is to use *one* or *that* as in S5 and S6.

S5. * This can be done by using either a *chromatographic pump or a peristaltic one.*

S6. * With regard to the *TTC* output the *arbitrariness* of a g_{pk} parameter can be exploited by starting from *that* of g_{pa}.

To a native English speaker S4 and S5 sound quite strange and could easily be rewritten as:

S7. This can be done by using either a *chromatographic or peristaltic pump.*

S8. With regard to the *TTC* output the arbitrariness of a g_{pk} parameter can be exploited by starting from the *arbitrariness* of g_{pa}.

However, using synonyms is useful for some adjectives and verbs, particularly when you need to use these verbs and adjectives frequently throughout the paper. Examples:

We would like to *stress / underline / emphasize / highlight* that x = y.

We *performed / carried out / did* several experiments.

This is a *critical / very important / fundamental* issue.

6.17 Be as precise as possible

If possible aim at precision. Instead of saying something happened *in a number of cases*, be more exact: *this happened in 11 cases*. If you think that stating the exact number is not important or you do not have the exact number available, then try to use a concise expression.

SHORT	LONG
about	of the order of
few	few in number
many	a high percentage of
many	a large proportion of
most	vast majority of
never	never at any time
several	a good number of
some / -	a number of

A common mistake by authors is in making assumptions about what the reader will understand. This is because you as the author know your topic extremely well, in fact you may have been working on it for several months, even years. This means that you may use words and expressions which to you are clear, but to the reader may not be. Below are a few examples of words and expressions that could be interpreted in many different ways. In all cases you need to be more specific:

in the short term, in the near future

a relatively short / long duration

[quite a] high / low number of

recently, recent – bear in mind that the reader may be reading your paper several years after its publication

Referees often criticize authors for sentences such as:

S1. *Usually* the samples were cooled to room temperature.

S2. It was necessary to study the problem with *attention*.

S3. In the late 1990s *nearly all newspapers* created a companion website.

S4. Subjects performed *fairly* well and their results were *substantially* better than their counterparts.

S1: If you use adverbs such as *usually* and *normally* when referring to experiments or results then the reader might want to know what happens or happened in other cases.

S2: What exactly does *attention* mean? It may be useful to provide details regarding the level of attention and what it entailed.

S3: This was the first sentence in an abstract analyzing online newspapers in Italy. It is not clear whether this is a general statement about newspapers in all the world, or just in Italy. This is a classic case of when the author knows what he / she is referring to, but the reader is left in doubt.

S4: Adverbs such as *fairly* and *substantially* mean different things to different people are. Other examples of potentially ambiguous adjectives and adverbs are: *adequate,*

appreciable, appropriate, comparatively, considerable, practically, quite, rather, real, relatively, several, somewhat, suitable, tentative, and *very*. These adjectives and adverbs do not have a single unequivocal meaning. They can be open to interpretation by the reader. Often they are redundant or need to be made more precise as in S5 and S6.

S5. * Sampling took place in a *relatively short* but *significant* period of time.

S6. * We used a *suitable* method for the computation.

How long is *relatively short*? What does *significant* mean? What exactly is *suitable*?

In S5 would be better to specify what the exact time was, why it was significant. In S6 it might useful to explain what the method was.

6.18 Choose the least generic word

Another way to be more precise is to choose the least abstract / generic word. In S1 and S2 a generic word is followed by specific definition - this type of construction is often an unnecessary repetition.

S1. **This kind of investigation, i.e. the analysis of the AS profiles*, also aims to find sets of nodes which behave similarly and …

S2. **Climatic conditions (i.e. temperature, rainfall)* were also checked.

Decide whether you can delete the preceding phrase and just use the definition. S3 and S4 are more concise, more precise, and save the reader from reading redundant abstractions.

S3. By analyzing AS profiles we can also find sets of nodes that behave similarly and …

S4. Temperature and rainfall were also checked.

If you can, always choose a word that is the lowest in the ladder of abstraction. Three examples are shown in the table below, ranging from the most abstract (at the top) to the most concrete.

EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
language	construction	cut
writing	car manufacturing	divide up
words	sports cars	chop, dissect, shred
phonemes	Ferrari 612 Scalgietti	halve

Obviously, there are occasions where you may want to be deliberately vague (see Sect. 9.5). But if you can, use the most specific word possible so that readers will be able to follow you much better.

6.19 Summary

Your writing will be much clearer if you take into account the following:

- *which* is used for adding information about the preceding noun, *that* defines the preceding noun
- *which, that* and *who* should only refer to the noun immediately preceding them
- the *-ing* form (gerund) has no subject. Make sure it is clear what the subject of the *–ing* form is.
- clarify whether something is a consequence of doing something or a means to do something by using *thus* (consequence) and *by* (means) before the – *ing* form
- use the definite article (*the*) before a noun only if you refer to a specific example of that noun. If you are giving a generic idea, do not use the article
- learn the most frequent uncountable nouns and false friends in your field
- be very careful when you use pronouns (*this, that, them, it* etc.) – make sure it is clear what they refer to and don't be afraid of repeating the same word many times (if this will improve clarity)
- avoid using *the former … the latter,* simply repeat the related noun
- if necessary specify exact locations, when using *above* and *below*
- use *respectively* when it is not 100% clear how items are related to each other
- be careful of punctuation with *which* and *and* – punctuation must help the reader understand the relationships between the various parts of the sentence
- don't confuse *both … and* (inclusive) with *either … or* (exclusive); and *i.e.* (definitions) and *e.g.* (examples)
- never use synonyms for key words, only for generic verbs and adjectives
- use the most precise word possible

There are other serious cases of ambiguity. These are dealt with in separate chapters of this book.

1. strings of nouns and adjectives (Sects. 2.15 and 11.12)
2. misusage of tenses - using the present instead of the past, and vice versa, can create considerable confusion, particularly in the Introduction and Discussion sections (Sects. 13.7 and 17.7)
3. poor or incorrect word order (Sect. 2.16).
4. when it is not clear if you are referring to your own work or other people's work (Sects. 7.3, 7.4, 7.7, and 7.8)

Chapter 7
Clarifying Who Did What

Why is this chapter is important?

In various sections of your paper, you need to compare your methodology or results with what has already been established in the literature. You must make it 100% clear to the reader whose methodology or results you are talking about. If you don't, you will make it difficult for the referee to:

- identify your contribution
- decide how useful the contribution is
- make a decision about whether this contribution is worth recommending for publication

For example, if you say *It was found that X = 1*, the referee needs to know whether you found that X = 1, or whether another author made this finding.

This chapter shows you how to make such distinctions.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_7,

Typical complaints of Referees

The manuscript cannot be accepted for publication until it has been revised in accordance with the style guidelines of The Journal. At the moment the authors have referred to themselves as we*, this is not accepted practice in Physics.*

In its current form, it is hard to tell when the author is referring to his/her work or the literature in general. This has seriously compromised my ability to assess the merit of the paper, and thus whether it is worthy of publication.

The Introduction and Discussion should be revised so that readers can clearly understand the contribution that the author is making.

7.1 Check your journal's style - first person or passive

Check your journal's 'guidelines to authors' to see whether you are permitted to use *we*. If you can use 'we' then it is relatively easy for you to distinguish between your work and others. Some journals, particularly those regarding Physics, tend to opt for an impersonal form in the belief that science is independent of the person writing about it. This entails adopting a lower profile and using the passive form (Sect. 7.2).

If your journal insists on the passive form, you need to be extremely careful. The most important point to remember is that YOU know which is your work and which is someone else's. But the readers do not! You must make it clear for THEM.

7.2 How to form the passive and when to use it

Active: We ***performed*** two tests. Blake et al. ***carried out*** one replication.

Passive (*is / was / will be* etc. + past participle): Two tests ***were performed*** (by us). One replication ***was carried*** out by Blake.

The passive is particularly useful when you describe a process, for example in the Methods. This is because it puts the equipment, chemicals, procedures etc. that you used in the first position in the phrase. In review papers, and in other sections of research papers, for example the Introduction and the Discussion, you may want to use the passive to describe what other authors have done, or what is already established knowledge in your domain. In such cases you can say:

S1. Bilingual children *have been demonstrated / are believed* to adapt better to new situations than monolingual children.

S2. *It has been demonstrated / It is believed* that bilingual children adapt ...

The advantage of S1 over S2 is that the subject of the sentence (*bilingual children*) is at the head of the phrase, whereas it is delayed in S2.

Note that in formal English writing you cannot use *someone, one* or *people* to refer either to a particular person or a generic person. This means that you cannot replace S1 and S2 with S3 or S4:

S3. * Someone / One has demonstrated that ...

S4. * People believe that ...

7.3 Ensure you use the right tenses to differentiate your work from others, particularly when your journal prohibits the use of *we*

The following extract is the first paragraph of a Discussion (though something very similar might also be found in an Introduction). It is poorly written because often it is difficult to understand if the verb refers to something Wordsworth (a fictitious author) did or found, or to something another author did or found.

> ORIGINAL VERSION: Bilingual children *(1) were found* to show a greater adaptability to new situations (e.g. change of school, change of diet) and demonstrated a greater ease in communicating confidently with adults [Blake, 1995]. As result of an extensive search for bilingual children in ten European countries, 149 children *(2) were identified* (Table 1). One hundred and twenty two children with parents of different nationalities *(3) were assigned* to a group (hereafter Group A). It *(4) has been found* that those children with parents of the same nationality but who live in a foreign country (for example, a child with English parents living in Italy) *(5) have* a greater level of adaptability than those children with parents of different nationalities living in the native country of one of the parents. Similar adaptability levels *(6) have been found* in trilingual children of parents of different nationalities living in a third country [Coleridge, 2011], for example the child of a Dutch/Russian couple living in France. However, in many such cases *(7) it was found* that one of the three languages was not as strong as the other two (Table 2).

Here is an analysis of my thoughts as I read the above extract.

1. The use of the past tense (*were found*) seems to indicate that this is Wordsworth's finding. But when I get to the end of the sentence I see the reference, so I now realize that this is Blake's finding.
2. Reading the first part of this sentence I am not sure if Wordsworth is adding more information about Blake's findings or if he is now going to talk about his own results. When I reach the end I see a reference to a Table, so I now assume that Wordsworth made the identification.
3. There does not seem to be any ambiguity here. Wordsworth is talking about what he did.

4+5. The change in tense from the PAST SIMPLE (*were assigned* in 3) to the PRESENT PERFECT (*has been found* in 4) followed by the present tense (*have* in 5) suggests that I am reading about another author's findings. But in reality, I suspect that these are Wordsworth's findings.

6. Because Wordsworth has misused the PRESENT PERFECT in 4, I think that he may have misused it again in 6, so my initial thought is that Wordsworth is talking about his own findings. But when I reach the end of the sentence I have to revise my thoughts because I now realize that these are Coleridge's findings.
7. I am now completely confused. Initially, I have no idea if *it was found* refers to Wordsworth or to Coleridge. When I see the reference to Table 2, I assume that these are Wordsworth's findings, though it might be possible that Table 2 refers to Coleridge's findings.

Below is a clearer version. The changes from the OV are underlined.

> REVISED VERSION: Bilingual children <u>*show*</u> *(1)* a greater adaptability to new situations (e.g. change of school, change of diet) and <u>*demonstrate*</u> a greater ease in communicating confidently with adults [Blake, 1995]. <u>*Blake investigated children from the US and Canada. As mentioned previously, the focus of our study was Europe and*</u> a result of an extensive search for bilingual children in ten European countries, 149 children *were identified (2)* (Table 1). One hundred and twenty two children with parents of different nationalities *were assigned (3)* to a group (hereafter Group A). It <u>*was found*</u> *(4)* that those children with parents of the same nationality but who lived in a foreign country (for example, a child with English parents living in Italy) <u>*had*</u> *(5)* a greater level of adaptability than those children with parents of different nationalities living in the native country of one of the parents. Similar adaptability levels *have been found (6)* in trilingual children of parents of different nationalities living in a third country [Coleridge, 2011], for example the child of a Dutch/Russian couple living in France. However, in many such cases <u>*our findings revealed*</u> *(7)* that one of the three languages was not as strong as the other two (Table 2).

The main difference with the original version, is that now the reader knows immediately from the beginning of the sentence whether these are Wordsworth's or another author's findings. In the original version, the reader is forced to wait till the end of the sentence before discovering whose findings are being discussed. Also, in the original version readers constantly have to make readjustments in their understanding as they move from sentence to sentence.

Now, let's analyze in detail the differences between the two versions.

(1) The use of the present tense (*show*) indicates to the reader that this is general knowledge, i.e. this is Blake's finding and not Wordsworth's. An alternative here would be to write *Blake [1995] showed that ...* However, this is an extract from a beginning of a section and it would be unusual to begin with an author rather than the main topic of the section (bilingualism). To make doubly clear that this is not his own finding, Wordsworth could have begun: *It is well known that bilingual children.* However this would delay the key word (*bilingual*).

(2) One problem in the OV was that there was no real connection between the first and second sentences, and this added to the confusion about whose work was being discussed. In the revised version a new sentence has been added to explain the connection and to introduce Wordsworth's work. Some information here was also contained in the Wordsworth's Methods section (i.e. that the focus is on Europe not North America), but readers do not necessarily read all parts of the paper. If the main contribution of the paper is in the findings rather than how the tests were set up, then the readers might well skip the Methodology and go straight to the Results and Discussion. By adding a few extra sentences to the Discussion, you can help readers orient themselves better.

(2+3) Because of the addition of the extra sentence, it is clear that *were identified* and *were assigned* are Wordsworth's findings.

(4) In the previous two sentences, Wordsworth has been talking about what he did, so the reader can assume that *It was found* refers to Wordsworth's work.

(5) The use of the PAST SIMPLE (*had*) rather than the PRESENT SIMPLE (*have*) makes it clearer for the reader that these are Wordsworth's findings. The general convention (but not rule) of tense usage in Results and Discussions sections is that you use the PRESENT SIMPLE, PRESENT PERFECT or PAST SIMPLE to refer to other authors but only the PAST SIMPLE to refer to your work. The PRESENT PERFECT should not be used to refer to work that you have carried out.

(6) The PRESENT PERFECT is fine here because Wordsworth is referring to AA's work. Wordsworth could also have used the PAST SIMPLE (*were found*).

(7) By using *our*, Wordsworth makes it clear that he has returned to talking about his own findings.

The OV highlights that:

- using figures, tables and references does not necessarily help the reader to understand whose work you are talking about. The reader still has to make an effort
- mistakes and inconsistency in tense usage can completely confuse the reader. If such mistakes are made frequently it could become quite irritating for the referee or reader

The RV demonstrates that

- you can still keep your journal happy by not using *we* - for some reason they raise less objections if you use *our*!
- each sentence should be a logical progression from the previous one. If you mention someone else's work and then your work in consecutive sentences, the connection between the two must be clear to the reader. It is not enough just to use two different tenses

7.4 For journals that allow personal forms, use *we* to distinguish yourself from other authors

The simplest way to make a distinction between your results and other author's is to use *we* - provided that your journal allows you to do this. Using *we* would make Wordsworth's Discussion (see Sect. 7.3) much clearer for the reader.

> Blake investigated children from the US and Canada, *whereas we studied* children in Europe. *We conducted* an extensive search for bilingual children in ten European countries and identified 149 children (Table 1). One hundred and twenty two children with parents of different nationalities *were assigned* to a group (hereafter Group A). *We found* that those children with parents of the same ...

The above revision highlights how making contrasts between what you did and what others did is much simpler when you use *we*. However, you don't want to begin each sentence with *we*, as this would be monotonous for your readers. So you can use a mixture of active (*we found*) and passive (*it was found*).

Only use the passive to describe your work if you have clearly established that now you are talking about your work. You can do this by using *we* or *in our study* at the beginning of a paragraph - this alerts the reader that you are going to discuss your

work, so even if you then use the passive the reader still knows that it is your work. If you then introduce someone else's work, make sure that the next time you talk about your own work again you begin the sentence with *we* or *in our study.*

7.5 Do not use *we* to explain your thought process

In the OV below the use of *we* serves no purpose (Sect. 5.12). Wordsworth (Sect. 7.3) is not distinguishing himself from other authors, he is merely sharing his thought process with the reader in order to guide them through his explanations. It is as if he is addressing a group of students while writing on the whiteboard. But for the readers there is no added value from this technique: it simply adds to the number of words and density of what they have to read.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
First of all, we need to explain the presence of unexpected values associated with trilingual subjects. *We justify* this behavior by bearing in mind that the fact that there may be some slight differences in the subjects' expertise from one language to another. *Let us clarify* this concept by focusing *our* attention on trilingual adults. In fact *we can see* that they present, at the same time, a lower number of vocabulary errors but a higher number of grammatical errors compared to bilingual adults. Since *our latter observation* may be counterintuitive, *we need* to underline that the presence of errors …	The presence of unexpected values associated with trilingual subjects is due to the fact that there may be some slight differences in the subjects' expertise from one language to another. In fact, in our tests trilingual adults had a lower number of vocabulary errors but a higher number of grammatical errors compared to bilingual adults. Note that the presence of errors …

The RV is much more concise. It is also easier and quicker to read. A whole paper written in the style of the OV makes the reader's task very heavy. Also, it slows down the pace of the paper.

7.6 When *we* is acceptable, even when you are not distinguishing yourself from other authors

When you describe your methodology or a procedure that you have followed, it is perfectly acceptable to use *we* or the passive, or a mixture of the two. This is illustrated in the example below.

> We selected the candidates on the basis of an initial test in which they were asked to do a short simultaneous translation. The candidates were then divided into two groups: bilinguists and trilinguists. Candidates then underwent a second test … We then used the results of these tests to further divide the candidates into four subgroups.

The extract above could be rewritten all in the passive. However, the advantage of beginning the description of the procedure using *we* is that it makes it clear to the reader that unless stated, otherwise the rest of the paragraph refers to what you did rather than another author.

The extract highlights that using a mixture of *we* and passive enables you to choose the focus of your phrase. *The candidates were divided* puts the focus on the candidates, whereas *We then used the results* focuses on what we did (i.e. our role is being emphasized). Mixing *we* and the passive also creates variety for the reader. Note also that the active is also sometimes used (*Candidates then underwent a second test*) thus highlighting that in some cases it is still possible to write in an impersonal way using active forms.

7.7 Make good use of references

The following extract is another example from Wordsworth's paper (see Sect. 7.3) where the reader has little or no idea which author made which finding. The principal problem in the OV is not connected with problems of tense usage, but of lack of references to the literature and the failure to use *we / our*.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Measurements (1) *were made* of the speed with which bilingual adults performed simultaneous translations of politicians' speeches because politicians tend to use formal language [Anderson and Wordsworth, 2008]. (2) *Similar tests* with Nobel prize winners' acceptance speeches gave similar values of speed. This finding strongly suggests that formal language represents an easier element for translation than informal language. The performance of teenagers (3) *in analogous situations* also confirms the above finding. Considering that informal language, in particular slang, (4) *intensifies* the stress levels of subjects undertaking simultaneous translation (5) *the lack of changes in stress levels* of the bilingual adults with respect to bilingual teenagers when simultaneously translating extracts from a teenage soap opera, would seem to indicate that experience plays an important role. Consequently, stress levels in bilingual subjects *tend* (6) to decrease with age.	*In a previous paper [Anderson and Wordsworth, 2008] we* made measurements of the speed with which bilingual adults performed simultaneous translations of politicians' speeches. We chose politicians because *it is well known that* they tend to use formal language. *In the same study [Anderson and Wordsworth, 2008] we* conducted similar tests with Nobel prize winners' acceptance speeches, which gave similar values of speed. *These two findings* strongly suggest that formal language represents an easier element for translation than informal language. The performance of teenagers in analogous situations also confirms the above finding [*Williams*, 2009]. *Williams* found that informal language, in particular slang, intensifies the stress levels of subjects undertaking simultaneous translation. *Therefore* the lack of changes *that we found in our present research* in the stress levels of bilingual adults with respect to bilingual teenagers when simultaneously translating extracts from a teenage soap opera, would seem to indicate that experience plays an important role. *As a consequence of our latest findings, we conclude* that stress levels in bilingual subjects tend to decrease with age.

The OV is extremely confusing, even though the use of the English language is perfect.

(1) *were made* indicates that this is Wordsworth's work, but when the reader reaches the end of the sentence he/she sees a reference to another paper. Does this reference just refer to the second part of the sentence (beginning *because politicians*) or does it refer to the *measurements*, or both? The reader cannot be sure. Moreover, authors who quote from their own previous work, as Wordsworth does here, should alert the reader that it is their work and not someone else's. The problem is that readers may not remember the name of the author of the paper they are reading, so even if they see Wordsworth in the reference they may not realize that he is the author of the current paper.

(2) *similar tests* by who? (Wordsworth or someone else?) and when? (in Wordsworth's 2008 paper or his current paper?)

(3–5) Again, the reader has no idea who conducted the tests and when, or whether they refer to the current research or Wordsworth's previous research.

(6) Who is making this conclusion? Is it Wordsworth based on his research in this paper? Or is it a general conclusion made by other authors and already reported in the literature?

As usual, the problem is due to the fact that Wordsworth knows who did what, and he assumes that the reader also knows this vital information.

The RV clarifies *who* did *what* and *when*. It also divides the OV into two paragraphs: one describing previous work, and the other describing the current work. The reader is carefully guided through various studies before reaching Wordsworth's conclusions for his present paper.

This results in an increase in the number of words you will need to use - but clarity is more important than conciseness.

I cannot overstress how important it is for you to make such differentiations between your work and that of others. Lack of such a differentiation is one of the most common and serious mistakes made in research papers. It is imperative that you check through every sentence in which you report a finding, and make it 100% clear to the reader who is responsible for the finding.

7.8 Ensure that readers understand what you mean when you write *the authors*

Another problem arises when in consecutive sentences you describe your results in relation to the results of two or more authors. In S1, it is not clear who *these authors* refers to.

S1. *Our results agree with those on bilingual teenagers in Scandinavian countries by Magnusson et al. (2011), and those from the Middle East by Hussein et al. (2009), who used middle school and high school pupils; *these authors* ruled out the existence of ...

These authors could refer to both Magnusson's group and Hussein's group, or just one or the other. If there is a possibility of ambiguity it is always best to specify the author again. In any case, S1 is very long and would be better written as S2.

S2. Our results agree with those obtained on bilingual children in Scandinavian countries by Magnusson et al. (2011). They also agree with studies in the Middle East by Hussein et al. (2009), who used middle school and high school pupils. Hussein et al. ruled out the existence of ...

7.9 Use short paragraphs

Throughout the Discussion, and sometimes during your Introduction, you will need to switch from your work to other authors' work. Each time you begin a new area of comparison, begin a new paragraph. This makes it much easier for the reader to follow.

Also consider using one paragraph to describe other authors' work and a new paragraph to describe your own. Constantly switching within the same paragraph from your work to other authors' can be quite hard for readers to follow.

For more on the advantages of short paragraphs see Sects. 2.12 and 8.1.

7.10 Make logical connections between other authors' findings and yours

When you write the various sections of your paper you know why you are referring to other authors, but the reader doesn't. You need to make the connections clear.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
In order *to assess the proficiency* of the bilingual children in *the* survey, a series of tests were carried out which involved simultaneous translations between the two languages in front of an audience of 20 people. *Tests of language skills* are best carried out under situations of stress [Tong 1992]. Data obtained from these simultaneous translations indicated that ...	*[It is well known that] tests of language skills* are best carried out under situations of stress [Tong 1992]. *Consequently, to assess the proficiency* of the bilingual children in *our* survey, a series of tests were carried out which involved simultaneous translations between the two languages. *Additional stress was created by making the children perform* in front of an audience of 20 people. Data obtained from these simultaneous translations indicated that ...

In the OV another author's findings (Tong's) are placed between two sentences containing the writer's own findings. The reader is thus forced to make his/her own connections between the three sentences. The RV rearranges the order of the sentences and adds the word *consequently*. This helps the reader to understand why the experiment was carried out. Also, replacing *the* with *our* makes it even clearer that the writer is talking about his own survey. Likewise, using the phrase *it is well known* alerts the reader that a general scientific concept is going to be introduced.

In the revised version above it is now much clearer how the writer's tests differ from previous ones by other authors. This difference is highlighted by beginning a new sentence: *Additional stress was created by making the children perform.* Again, you know what makes your methodology or findings different from the literature, but the reader may not.

7.11 Summary

- Follow the journal's instructions regarding whether you can use *we / I* or if you have to use the passive at all times.
- You may have the impression that the passive form is considered to be more elegant in scientific papers. Whether this impression is true or not, be aware that the passive inevitably creates problems for your readers because it may be difficult for them to know immediately and with certainty whether you or another author made a particular finding.
- Do not rely on a reference to a figure or a table, or a reference to the bibliography to distinguish your new data from those in the literature. Make sure the reference clearly indicates it is another author's work and not a previous paper by you.
- Be aware that if you make mistakes in the usage of tenses when you are comparing your work with other authors' work, you could really confuse your readers. Make sure you consistently use the correct tenses and remember that in English there is a real difference between the SIMPLE PAST (finished actions with time indication) and the PRESENT PERFECT (past to present actions, finished actions with no time indication)
- Avoid using *we* when it is not really necessary, i.e. to explain your train of thought.
- Help readers to distinguish between your work and others by using a series of short paragraphs, rather than one long paragraph.
- If you mention another author's paper, make sure that the reader understands why you are mentioning that paper and how it relates to your own work.

Chapter 8
Highlighting Your Findings

Why is this chapter important?

Your findings may be extremely valid and important. However, if the referees are not able to see or understand your findings because you have neither highlighted nor described them clearly enough, then your paper may not be published. Your contribution to the community may thus vanish into oblivion. In the words of English botanist, Sir Francis Darwin: *In science the credit goes to the man who convinces the world, not to the man to whom the idea first occurred.*

This chapter outlines how to use visual techniques (i.e. layout and sentence / paragraph length) and good use of language to make readers notice your key findings.

DOI 10.1007/978-1-4419-7922-3_8,

Typical complaints of referees

Given that the focus of this paper is on an 'innovative methodology', the author needs to make more effort to clarify what makes his / her approach special. I truly believe that the author is making a useful contribution but I reached that conclusion only by reading between the lines.

I have the strong feeling that the authors have overstated the achievements and the significance of their project, and thus may be guilty of bias. I recommend that they check all their data again to ensure that their conclusions are valid for all the results they obtained, rather than just a subset of them.

These data were interesting for readers but they are not sufficient to convince me that X affects Y. This is because the authors only showed the relationship between X and Y in the context of Z. Moreover, many points were not clear due to poor writing and an overall lack of a logical development.

8.1 Ensure that referees can find and understand the importance of your contribution

The way you talk about your findings has a crucial impact on whether the referees will recommend that your paper be accepted for publication. Below is an email to an author from the editor of journal explaining why he has decided not to accept the author's paper for publication. His reasons are based on the reports of two referees / reviewers. The email is genuine, I have merely made it anonymous.

> The reviewers concur that the research is insufficient to provide substantial new insight about the role of Xs. My perspective is that the *datasets potentially could be valuable information for the scientific community*. However, both reports indicate that despite the large number of Xs that were evaluated and the effort that this entailed, *the results do not define adequately P and Q*. Both reviewers express concerns about the experimentation, results and conclusions. Most importantly the *results are merely descriptive, and are insufficient to support the critical conclusions* about P and Q functions that are necessary to warrant publication in The Journal. Regrettably, I share the concerns expressed by the reviewers. Consequently, I have no alternative but to decline the paper for publication in The Journal.

Stimulated by the fact that their datasets could *potentially* be of value to the community, and because the referees felt the results were *merely descriptive* and did not define P and Q *adequately,* the authors then rewrote their Discussion. Their new version clearly highlighted the key points of their datasets and their important implications. The results they presented were exactly the same as before, in fact they did not subsequently do any new experiments in order to get 'better' results. They then resubmitted their paper to another journal and it was accepted. Clearly, the decision of the second journal to accept could have been motivated by other reasons, but the impact of rewriting the Discussion in a clearer and more powerful way will certainly have played its part.

8.2 Help your findings to stand out visually on the page by beginning a new paragraph

To be able to read your key findings and to understand the contribution of your paper, readers need to be able to easily find these key findings on the page. If your key findings are buried in the middle of a paragraph, there is less chance that readers will see them and read them. Readers tend to concentrate at the beginning and ending of paragraphs, rather than the middle.

The examples below are designed to show you the difference in terms of impact on the eye of one long block of text, and the same text divided into shorter paragraphs. You don't need to read the texts, but simply recognize the negative effect that a long paragraph has, and thus avoid such blocks of text in your own writing.

ONE LONG PARAGRAPH	THREE SHORTER PARAGRAPHS
This is one ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive. This is one ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive. This is one ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive. This is one ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive. Here are my findings you will be lucky if you can see them here buried in the midst of this ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive. And now I will continue with this ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive. So here we go again with this ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive. This is one ridiculously long paragraph containing all kinds of information about everything that you can possibly imagine and conceive.	This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. Here are my findings, which you can now see quite clearly. Note how this paragraph is also quite short. In fact, it is shorter than the previous and following paragraphs. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph. This is now a much shorter paragraph.

So when you have something important to say, begin a new paragraph. I call this paragraph the *key finding paragraph* (KFP). A KFP should, if possible, be a little shorter than the previous and following paragraphs. This will help it to stand out from the page.

A KFP should only focus on your key findings. There should be no (or minimal) background information or citations from the literature. The background and citations should be put in another paragraph.

8.3 Make your sentences shorter than normal

Readers' eyes tend to be attracted most to the white space between sentences and to the capital letter that begins each sentence (try testing this out for yourself). This means that shorter sentences are noticed more, and of course they are generally easier to follow and understand.

This visual factor is critical to the impact of your paper. It is very similar to a good oral presentation. When presenters have something important to say, they slow down the speed of their voice, speak a little louder or more emphatically, use much shorter sentences, and use particular adverbs (e.g. *importantly, interestingly, remarkably*) to attract attention. Presenters do this to (i) attract the audience's attention, (ii) to underline the importance of what they are saying, (iii) to help the audience understand what is being said.

Here is an example from a Discussion. The OV is one long sentence. The italics in the RV highlight where each new sentence begins.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The method developed in this work relies on a sample pre-treatment that allows a low final dilution, *guaranteeing, on the other hand,* a negligible shift of pH with regard to different specimens to be tested (±0.15 units from 23 samples tested)*; however, the slight shifts* of pH do not alter the response of the test, *as shown* by the overlapping of standard curves obtained by spiking buffers at different pH with IGF-1.	Our method relies on a sample pre-treatment that only requires a minimal level of dilution. *In addition, it guarantees* a negligible shift in pH with regard to the different specimens to be tested (±0.15 units from 23 samples tested). *Importantly*, the slight shifts in pH do not alter the response of the test. *This is revealed* by the overlapping of standard curves obtained by spiking buffers at different pH with IGF-1.

In the RV it is much easier for readers to quickly identify where the innovation in the author's method lies, what the results are, and how these results reveal themselves. Note the replacement of *however* with *importantly*. The link word *however* seems to suggest that something negative will follow, whereas the use of *importantly* shows that in fact it is something very positive.

To learn how to break up long sentences see Sect. 4.13.

8.4 Present your key findings in a very short sentence and list the implications

It is crucial that the referee (and readers) are clearly alerted to your key findings, and that they clearly see (literally on the page) the uses and implications. In S1, the key finding (i.e. Eq 2) is part of a 39-word sentence. It does not stand out on the page.

S1. *Equation 2 is the main result of our study and it can be used both in numerical codes to evaluate the impact of the presence of anomalies in the various samples taken, or for simple estimates for designing experiments.

There are several ways to improve S1. The first is to use numbers.

S2. Equation 2 is the main result of our study. It can be used: (i) to evaluate in numerical codes the impact of the presence of anomalies in the various samples taken; or (ii) to make simple estimates for designing experiments.

In S2, Eq 2 is now in a sentence of only nine words. A very short initial sentence when introducing a key finding encourages the reader to pay more attention. Note also that in S2 that the two phrases regarding the uses of Eq 2 now have the same type of grammatical construction (infinitive form of verbs - *to evaluate* the impact, *to make* simple estimates). In the OV there was no such parallelism in construction.

If you don't want to use numbers, an alternative way to rewrite S1 is S3:

S3. Equation 2 is the main result of our study. It can be used for two purposes. Firstly, to evaluate in numerical codes the impact of the presence of anomalies in the various samples taken. Secondly to make simple estimates for designing experiments.

A third alternative is bullets, see Sect. 8.5.

8.5 Consider using bullets and headings

We tend to notice bullets (bulleted or numbered) more than blocks of text. So if your journal's style guide allows, occasionally use bullets to summarize important points.

You need to follow certain conventions when using bullets. The most important is that each bullet begins with the same grammatical part. The OV below uses two different grammatical constructions, whereas in the RV the infinitive is used in both bullets. This is a stylistic rule, but it also aids reader comprehension by presenting the various elements of information in the same way.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Equation 2 is the main result of our study. It can be used: • in numerical codes to evaluate the impact of the presence of anomalies in the various samples taken • for simple estimates when designing experiments	Equation 2 is the main result of our study. It can be used to: • evaluate in numerical codes the impact of the presence of anomalies in the various samples taken • make simple estimates for designing experiments

Your decision about whether to use standard bullets or numbered bullets will depend on whether you will refer to the elements in the bullets in the following text. If you have a list of three or more bullets, and you need to refer to them, then it is easier to number them.

For more on the use of bullets, see the companion volume English for Research: Usage, Style, and Grammar.

Some journals do not force you only to use the standard main headings (Introduction, Methods etc.). You can also use subheadings to direct your readers' attention to important aspects of your work.

8.6 Use tables and figures to attract attention

Another visual way of attracting attention is to place tables and figures strategically throughout the paper. The readers' eyes will inevitably be attracted to any non-textual information, such as graphs and tables. The next thing their eyes will focus on will probably be the legend to the figures, and then the paragraph immediately following the legend. So use this paragraph to make an important point.

Of course tables are also the perfect way to summarize key findings. Check the maximum number of figures and tables that your journal allows, and keep them as relevant and concise as possible.

8.7 Signal to the reader that you are about to say something important by using more dynamic language

You can attract readers' attention not only through visual techniques, but also by the words you use.

The following adverbs, used at the beginning of a sentence, are effective in signaling to readers that you are now going to tell them something important:

> *importantly, intriguingly interestingly surprisingly, incredibly, remarkably, significantly, unfortunately*

You can also use adjectives that add a positive feeling to what you are saying, for example: *advanced*, *attractive, convincing, cutting-edge, effective, favorable, important, novel, productive, profitable, successful, superior, undeniable, valuable.* You can make them even stronger by adding *extremely* or *very* in front of them, but you may find that they have just as much or more impact without these extra words.

In any case, you should only use these adverbs and adjectives once or twice, otherwise they lose their impact or you may be considered as being arrogant (Sects. 9.2 and 9.4). If you have something less important to say, you could probably just use a link word such as:

- *in addition* - to add an additional comment, benefit or feature
- *however* - to signal that you now have something to say that qualifies what you have just said
- *in contrast* - to highlight that what you are going to say next goes against what you have just said

8.8 Only use specific terms when describing your key findings

Readers are more interested in reading specifics than general concepts (Sect. 6.18). Particularly when you give your key findings, you need to use the most concrete and specific words and phrases possible. If you don't, you are in danger of losing the attention of the reader.

8.9 Avoid flat phrases when discussing key findings

The way you write a phrase should reflect the importance of what you are saying. S1 reports one of the key findings of a paper.

S1. *A comparison of X and Y revealed the presence of two Zs, one located in Region 1 as previously identified in the Z subgroup (Marchesi *et al*., 2009), and the other in Region 2 (Figure 6). This finding suggests the presence of another transcriptor factor that …

There is nothing in it that says to the reader 'Hey, this is really important. It is a key finding that I really want to draw your attention to - please take note of this'. In reality the authors of S1 were talking about an amazing genetic discovery. Until they wrote their paper only one Z had ever been found. It had been found by Marchesi and colleagues. The fact that the authors had found another Z in a different location was the fundamental finding of their whole paper. But they presented this information in the same way as they reported the general state-of-the-art in their introduction. After their paper had been initially rejected, they rewrote the sentence as in S2.

S2. Since Z has only ever been found in Region 1 (Marchesi *et al*., 2009), we were surprised to identify Z in Region 2 as well. Our discovery suggests the presence of an unidentified transcriptor factor that …

S2 focuses on the key finding (i.e. Z). Z is now placed at the beginning of the sentence. How they made this finding has already been described in the Results (i.e. through *a comparison of X and Y*), so they don't really need to mention X and Y here too. They use much more emotive language – *surprised, discovery, unidentified* – which is designed to draw the reader's attention to the importance and contribution of their work.

Here is an example from the Abstract of a paper on cow's milk.

S3. *In this study, we set up a system to quantify the level of X in milk, relying on a particular kind of pre-treatment allowing a low dilution of the sample.

S4. In this study, we set up a system to quantify the level of X in milk. Our method is highly effective and less expensive than other options currently available. In fact, it uses a special pre-treatment, which means that the sample only requires a minimal level of dilution.

S4 is much more effective in conveying the validity and utility of the author's system. It does this by:

- splitting the long sentence of S3 into two shorter sentences
- making a comparison with previous methods
- using clearer language to highlight the implications of the pre-treatment

8.10 Be explicit about your findings, so that even a non-expert can understand them

Your paper may not only be read by people working in exactly the same field as you. In order to acquire funding to continue working in research, some researchers have to change from their field into a more financially retributive field. This means that some people who are not completely familiar with your field may need to read your paper.

S1 is the last sentence of an abstract dealing with the effect of Panama disease on bananas.

S1. Results obtained have management implications and suggest that there is a high degree of improbability that sound fruit will be subject to an infection process by Panama disease and wounds have an inherent tendency towards a phenomenon of infection susceptibility with regard to bananas, therefore, necessary steps should be taken to set in place various guarantees so that bananas are handled in an adequately careful manner in order to undertake a strategy of lesion prevention.

The findings have huge implications with anyone involved in banana production and sales, yet their importance is difficult to decipher from S1.

S2 is much more concise (41 words rather than 75) and clear:

S2. Our results highlight firstly that Panama disease is unlikely to infect sound fruit, and that secondly wounds make fruit susceptible to infection. It is thus critical to handle bananas carefully so as to prevent wounds that are conducive to this disease.

In S2 it is clear that the findings are those of the author (*our results*). The long sentence has been divided into two shorter sentences. Much of the redundancy has been removed along with abstract nouns that add no value (*tendency*, *process, phenomenon, strategy etc.*). Readers can now understand that there are two key findings (*firstly, secondly*). The same key terms have been used, i.e. just *wound*, rather than *wound* and *lesion* (which both have the same meaning, but readers may think they are used to mean different things).

However, the findings and implications could be made even more explicit:

S3. Our results highlight that Panama disease is unlikely to infect sound fruit, but rather it is wounds that make fruit susceptible to infection. Thus the best way to avoid infection is by ensuring that the fruit is handled carefully and not wounded. This is clearly critical for those involved in picking, packing, transporting and displaying bananas.

S3 can be much more easily understood by non-experts, for example by those who have just begun to do research in this area, and those who are not researchers but can benefit from the research (e.g. banana producers, handlers, retailers). The relationship between the effect of the disease on sound fruit versus wounded fruit is now even clearer through the use of *but rather*. The third sentence in S3 contains information that was not given in S2, but makes the *management implications* mentioned in S1 explicit i.e. careful handling during *picking* etc.

In fact, the term *management implications* has little meaning for the readers, even though it may be obvious for the author. This is a very common problem: the author has an idea, and he / she expresses it in a very generic way and expects the readers to understand how this generic way might be specific in this particular context. It is much better to be explicit and to give examples of what you mean.

Finally, S3 is written in uncomplicated English that anyone can understand. I am not suggesting that this user-friendly style should be adopted in every sentence of the paper. In fact, you might be criticized for being 'too informal' or not sufficiently 'scientific' if you used this style throughout your paper. However, when you are saying something of critical importance, then it helps to use such a direct style. This will make your message 100% clear to everyone – to the referee, to the expert reader, and to the inexpert reader.

8.11 Convincing readers to believe your interpretation of your data

Data can often be interpreted in more than one way. One reason for a paper being initially rejected is that the referee may interpret your data in a different way from how you have interpreted your data. The referee may then request that you to do further experiments / research just to check whose interpretation is correct. In some cases, such extra experiments may be useful, but they will delay your paper being published.

One way to avoid the referee making such requests is to predict what these requests are likely to be. Then you deal with them already in your initial manuscript in a way that your referees will be willing to digest (Sects. 9.11, 9.12, and 17.8).

So, let's imagine that you have made a calculation of one plus one and found that the result is three, contrary to the normal result of two. You have your own explanation for this strange result. You know that there are two other possible hypotheses for interpreting your data - H1 and H2 - but in any case you want your own hypothesis, H3, to be seen as the only possible interpretation. The secret is not to ignore H1 and H2, but to deal with them explicitly. You do this by investigating them (either fully or partially) and by proving that they are not possible explanations. The key is to do so in such a convincing way, that the referee then does not feel the need to request you to investigate H1 and H2.

Below is a fictitious example of how to convince the referee to accept your hypothesis (H3) rather than H1 or H2.

> We believe that there are three possible ways of interpreting our findings. The first, H1, is that the result of three, contrary to the normal result of two, can be explained by … However, if this were the case, then the result should have been four. In fact, H1 is probably due to the rather low computational power, which the authors [Bing et al 2006] who originally proposed H1 later admitted … Moreover, Bing's methodology may have suffered from …
>
> The second interpretation, H2, proposes that ….. H2 has found some agreement in the literature [Chan 2009, Marx 2011], however as highlighted by [Uswe 2011], H2 is the result of a discrepancy in the X values due to …
>
> We thus believe that it is reasonable to discount H1 and H2, and that H3 provides the most reliable explanation for this apparently strange result. In addition, our finding is consistent with …
>
> Further evidence for H3 is that …

The trick is be completely open about the evidence against you and to deal with it step by step in a logical manner. In the example above, this logic is highlighted by having separate paragraphs for each element of the author's argumentation.

Link words (e.g. *thus, in fact*) are also very helpful in constructing this logic. Note how when describing the evidence against such H1 and H2, the author uses *however* and *moreover*. *However* is often used to diminish the importance or to question the implications of what has been said before, and is thus perfect in this situation. There is a difference between *moreover* (used at the end of the first paragraph) and *in addition* (end of third paragraph). Both are used to add additional information in support of what has been previously said, but *moreover* is sometimes used to add a further negative factor, whereas *in addition* tends to be used to add a further positive factor. Here is another example to highlight the difference between *moreover* and *in addition*:

> This paper is written badly, moreover much of the data is inaccurate.
>
> This paper is extremely well written. In addition, the method is very innovative.

8.12 Show your paper to a non-expert and get him / her to underline your key findings

A great way of discovering how explicit you have been in presenting your key findings is to show a non-expert your paper. Ask them to underline where they think you have introduced and discussed your key findings. This task should be possible even for someone who knows nothing about your topic. If they fail to underline your key findings, then you know that you need to highlight your key findings even more.

If you want to be more thorough, you could get the same person also to find places where you discuss the implications and limitations of your research.

8.13 Beware of overstating your project's achievements and significance

This chapter has been all about highlighting your findings so that readers can both physically see them on the page and also appreciate their significance. But no research, study or project is perfect. You need to be explicit not just about the strengths of your work, but also the weakness and potential for bias (e.g. in your selection and sampling procedures).

Particularly in the Discussion you should purposively offer alternative explanations that take into account any potential for bias or limitations in your methodology and in the interpretation of your results. Such insights into these areas will be seen by the referee and readers as a sign of the quality of your research.

On the other hand, if it seems you are overstating the meaning of what you have found, the referee may suspect you of research bias. This may mean that your paper will be initially rejected.

8.14 Summary

- Be aware of how the layout of your paper can affect where readers focus their eyes - break up long blocks of text using shorter paragraphs and figures / tables
- Begin a new paragraph when highlighting something important
- Use shorter sentences and paragraphs to make your key points
- Use more dynamic language - make sure the reader understands immediately that you are about to say something important
- Don't just tell the readers that something is important – show them
- Tell your readers the implications of your findings
- Talk about your weaknesses not just your strengths; do not make the referees suspect any bias in your work

Chapter 9
Hedging and Criticising

Why is this chapter important?

Modern day scientific writing had its origins in England and many stylistic rules were devised by British scientists. One ‘rule’ is that when you present subjective or unproven propositions, you should avoid sounding arrogant or 100% certain of what you state. This approach, known as ‘hedging’, also spread to other scientists in other Anglo societies.

Given that many of the world’s most important journals are based in the USA and the UK, you should consider stating your claims (i.e. things that you believe that you have proved in your experiments and propose as being possibly true, but which in the future could possibly be proved by others to be unfounded) in a slightly softer way than you may normally do in your own language. So particularly in the Discussion and in the Conclusions you may occasionally need to use words and expressions that are not too direct and seem more tentative.

This chapter is designed to help you to:

- learn to anticipate (i.e. predict) possible objections to your claims. This means being able to make claims about your findings in a way that the referee, and subsequently the community, is more likely accept them
- criticize the work of other authors in a constructive manner by building upon their findings rather than underlining their inadequacy

Both these skills entail the cultural concept of ‘face saving’. Face saving means not putting yourself or another person in a position where others could perceive you or them as having failed.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_9,

What the experts say

There is no absolute knowledge. And those who claim it, whether they are scientists or dogmatists, open the door to tragedy. All information is imperfect. We have to treat it with humility.

from 'The Ascent of Man' by Jacob Bronowski, Polish-born British mathematician

In England it is bad manners to be clear, to assert something confidently. It may be your personal view that two and two make four, but you must not state it in a self-assured way because this is a democratic country and others may be of a different opinion.

from 'How to be an Alien' by George Mikes, Hungarian-born British author

Hedges are central to academic argument and are abundant in research articles. Because they withhold complete commitment to a proposition they imply that a claim is based on plausible reasoning rather than certain knowledge. This protects the writer against being proved wrong while recognizing alternative ideas on the subject.

Professor Ken Hyland, Director, Centre for Applied English Studies and Chair of Applied Linguistics, University of Hong Kong

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9.1 Why and when to hedge

Hedging entails anticipating possible opposition by your referees and readers by not saying things too assertively or directly. A hedge was originally a fence or boundary delimiting an area of land – it was thus a form of protection from outsiders. Today, hedge has a metaphorical meaning – you protect yourself against some adverse risk. In your case, the risk is criticism by referees and other researchers. The idea is that you express yourself with honesty, precision and caution, and you are diplomatic in any criticisms you make of other authors.

If you learn how to hedge, it may help you on the way to gaining acceptance in your field. On the other hand, if you seem to be too sure of yourself, you might alienate the referee and potential readers.

Hedging does not mean that you should be vague. In fact, you must be precise as possible. It is simply that you express this precision in an open-minded way that encourages other authors either to agree with your hypotheses or to postulate their own.

Here are two examples of what some referees (particularly British) might consider to be rather arrogant.

S1. *Although many authors have investigated how PhD students write papers, *this is the first attempt* to systematically analyze all the written output (papers, reports, grant proposals, CVs etc.) of such students.

S2. **Our results demonstrate that* students from humanistic fields produce longer written texts than students from the pure sciences and this *is due to the fact* humanists *are* more verbose than pure scientists.

Some referees might interpret these as being arrogant because the authors leave no room for doubt. In S1 can they be sure that this is the *first* attempt? Have they read all the literature from all the world? In S2 they are only talking about their interpretation of their results that came from their sample – they cannot be sure that other researchers will not have a different interpretation or draw different conclusions from a different sample. Also, *this is due to the fact* gives the idea that this is the only possible explanation, whereas in such a subjective area there will certainly be other interpretations.

Not all referees will interpret S1 and S2 as being too assertive. In fact scientists from many parts of the world write like this in their native language. So they are unlikely to criticize it when they see it in English. In addition, not all scientists are in favor of hedging, particularly as it is a very culture-driven device (see extract by Alistair Wood in Sect. 10.2).

However, it is not difficult to hedge your propositions. Hedging is unlikely to compromise the publication of your paper and in most cases will increase it, as illustrated in S3 and S4 (which are revised versions of S1 and S2):

S3. Although many authors have investigated how PhD students write papers, *we believe / as far as we know / to the best of our knowledge* this is the first attempt to systematically analyze all the written output (papers, reports, grant proposals, CVs etc.) of such students.

S4. Our results *would seem to* demonstrate that students from humanistic fields produce more written work than students from the pure sciences and *this may be due to the fact* that humanists are generally more verbose than pure scientists.

Obviously you don't need to 'hedge' every time you use the verbs *show, demonstrate, reveal* etc. So for example, you can say: *Table 2 shows that X had higher values than Y.*

You only need to consider 'hedging' when you are making a big statement that could be open to interpretation or contention. In S5 the author is making a claim that goes against currently accepted knowledge (or myth) that cats are smarter than dogs.

S5. *Our results *prove* that dogs are more intelligent than cats.

S5 would be better rewritten as one of the following:

S6. Our results *would seem to indicate* that dogs are more intelligent than the cats.

S7. A *possible* conclusion *would be* that dogs …

S8. Our results *may be a demonstration* that dogs …

S9. At least in terms of our sample, dogs *appeared* to be more intelligent …

The examples in this subsection highlight that hedging often simply involves:

- adding a few words before making your claim: e.g. *we believe* (S3), *would seem to* (S4, S6)
- adding an adjective or adverb: e.g. *possible* (S7), *generally* (S4)
- replacing verbs that indicate 100% certainty, for example *prove, demonstrate is* (and other forms of the verb *to be*) with *may be* (S4, S8).

Of course, there are more subtle ways of hedging. An example of a very famous hedging statement is when James Watson and Francis Crick presented the structure of the DNA-helix in their famous 1953 paper. They wrote:

> *It has not escaped our notice that* the specific pairing *we have postulated* immediately *suggests a possible* copying mechanism for the genetic material.

As a non-native speaker, you cannot be expected to write in such a subtle way. But at the same time, if you are not already well established in your field, you cannot afford to state as one of your findings that:

> This structure has *novel* features which are of *considerable* biological interest.

The above quotation is again from the same paper by Watson and Crick.

9.2 Highlighting and hedging

Chapter 8 dealt with how to highlight the importance of your findings. Highlighting and hedging are not contradictory skills, in fact they should be used hand in hand. Highlighting means, for example:

- helping the reader to see your findings on the pages of your manuscript (e.g. not hiding key findings in the middle of a long paragraph)
- using shorter sentences when giving important information
- using more dynamic language when drawing attention to key findings than when talking about standard issues

You can do all the above and still hedge where appropriate.

S1. This is a very important finding.
S2. *These results suggest that* this is a very important finding.

S2 gives exactly the same information as S1, but the first part of the sentence makes the author seem more modest in her claim and protects her from anyone in the future who might find that her results do not constitute an important finding. In other words the phrase *These results suggest that* is like a safety net for the author.

But S2 also qualifies as a 'highlighting sentence' because it is still a short (10 words) and simple sentence, which will attract the reader's attention. It also retains 'dynamic language' - *very important*.

S1 would be fine if you were discussing someone else's findings. It may even be acceptable if you use this to talk about your own work, provided that you then immediately explain why it is an important finding (i.e. you don't just tell readers that something is important, you show them as well). Without such an explanation S1 could sound arrogant. Also, you should only use such a strong declaration once or twice in an entire paper, otherwise it will lose its effect in addition to sounding arrogant.

The same is true for the use of adverbs such as *interestingly* and *surprisingly*. Such adverbs can be used in a sentence that both highlights and hedges.

S3. *Interestingly*, these results *prove* that X is *fundamental* in producing Y.
S4. *Interestingly*, these results *suggest* that X is *fundamental* in producing Y.

There is no real difference in meaning between S3 and S4, but the use of *suggest* rather than *prove* simply protects the author from any future contrasting findings or conclusions by other authors. In both S3 and S4, *interestingly* attracts reader attention. Again, the key is not to use such words more than once or twice.

The skill is in finding the right balance of highlighting and hedging, and also in knowing how to hedge so that referees and readers perceive you as being sincere.

Sections 9.3–9.6 focus on how to tone down (i.e. reduce the strength of) various grammatical parts of a sentence to a degree that most referees would consider to be a more appropriate level of assertiveness, confidence and certainty.

9.3 Toning down verbs

There are some verbs that leave no room for doubt, for example: *is / are, means, equals, demonstrates, proves, manifests.*

S1. This factor *is* responsible for the increase in ...
S2. These results *demonstrate* the importance of ...
S3. These findings *are conclusive proof* that x = y.
S4. This problem *manifests* itself in …
S5. This *means* that x = y.

S1–S5 give the reader no space to choose another possible interpretation. Such claims are very strong when used in reference to your own findings, but may be fine when talking about the literature.

Softer versions of S1–S5 are in S6–S10, respectively.

S6. This factor *may be* / *is probably* responsible for the increase in ...
S7. These results *would seem to show* / *indicate* / *suggest* the importance of ...
S8. These findings *provide some evidence* / *appear to prove* that x = y.
S9. This problem *tends* / *seems* / *appears* to manifest itself in ...
S10. This seems *likely* / *probable* / *possible* that x = y.

S7–S9 make use of two verbs, the first (*seem, appear, tends*) reduces the power of the second (*show, prove, manifest*). Other useful verbs with a similar function are: *help, contribute, have a tendency,* and *be inclined.*

9.4 Toning down adjectives and adverbs

Some adjectives and adverbs have a very strong tone. Here are some examples:

innovation: *innovative, novel, cutting edge, seminal, pivotal*
importance: *extremely important, very significant, of central / vital / fundamental importance*
certainty: *clear(ly), obvious(ly), evident(ly), conclusive(ly), definite(ly), undeniable, undeniably, undoubtedly*

When you are referring to your own work, you need to be careful how you use the above adjectives and adverbs. You might risk being accused of being too sure of yourself. For example:

S1. *This *pivotal* approach is *particularly interesting* for physicians.

The adjective *pivotal* describes something that is of vital or central importance. An expression such as *this pivotal approach* (S1) makes the author sound rather arrogant, since it is he or she who is assessing his / her own work. Such an expression, however, would be totally acceptable if the author were using it in a review of someone else's approach. S1 also states that the author's approach will be *particularly interesting* for doctors, but perhaps the author should let the doctors decide for themselves how interesting the approach is. It would be more acceptable to write:

S2. Our approach would lend itself well for use by physicians.

S3. We hope that physicians will find our approach useful.

S2 is more modest. It does not explicitly state the importance of the approach and the conditional *would* makes the claim more tentative. S3 is even more modest.

To protect yourself from accusations that you are too certain about your findings you can use adverbs and adverbial phrases such as *somewhat, to a certain extent, relatively,* and *essentially* as well as adverbs of probability and possibility such as *probably, likely*, and *possibly*. For example, both S4 and S5 could be considered very strong claims in certain circumstances.

S4. X is related to Y.

S5. X is certainly related to Y.

S6 and S7 take a more indirect approach.

S6. X is somehow related to Y.

S7. X is likely related to Y.

S6 is a hedge on <u>how</u> X is related to Y, whereas S7 is a hedge on the <u>probability</u> of X being related to Y.

Other useful adverbs for taking an indirect approach to interpreting the level of certainty in your findings are: *apparently, presumably, seemingly*.

9.5 Toning down strong claims by inserting adverbs

Different adverbs have different levels of power, which indicate different levels of confidence. If you are talking about how visible something is or how easy it is to detect, you could say:

S1. X was *clearly* visible.

S2. X was *scarcely* detectable.

S1 and S2 indicate confidence at both extremes of the visibility spectrum. However, if you think that there is an element of subjectivity in this visibility you can insert another adverb or phrase to reduce the power of the main adverb. So you could say:

S3. X was reasonably clearly visible.

S4. X was scarcely detectable, at least in our experiments.

You can use the same techniques to describe the level of agreement, correlation or matching.

S5. Our data fit perfectly with those of Mkrtchyan.

The confidence level of S5 could be reduced as in S6.

S6. Our data fit quite well with those of Mkrtchyan.

Words like *quite (reasonably, sufficiently, adequately, satisfactorily, suitably, appropriately*) leave your claim open to interpretation. They are vague enough to allow anyone to attach their own meaning to what you are saying. However, you don't want to use them more than once or twice, as otherwise you may risk being accused of being too evasive or equivocal.

Other words you could use to replace *quite* in S6 are *surprisingly, remarkably,* and *unexpectedly*. These words attribute a very subjective element to the interpretation of the data, and again leave readers free to give their own meaning to what exactly the author meant. However, again, you need to be careful (Sect. 9.3), and if do you use such adverbs, it helps if you say what was surprising, remarkable or unexpected about them.

Use the adverb *significantly* wisely. It is often associated with statistics and simply means that something is unlikely to have occurred by chance. So it does not have the general meaning of being important or noteworthy.

Sometimes, you need to talk about the level of completeness of an operation or activity. In such cases you can use adverbs such as *partially, in part, to some extent,* and *to a certain extent*. Again, these are rather vague expressions, if possible you should try to quantify them.

9.6 Toning down the level of probability

Another way to hedge your claims is to give readers an indication of how likely your findings are correct. There are many ways of expressing this kind of probability. The percentage probabilities in the example below should only be seen as very general indicators.

MODAL VERBS

X *must / cannot* play a role in Y. (100% certain)

Smoking *can* cause cancer. (100% - this does not mean that smoking always leads to cancer, but only that it has been proved that in certain circumstances smoking is the cause of cancer)

Future work will entail investigating X, which *should* prove whether x is equal to y or to z. (80%)

Smoking *may / might* cause antisocial behavior. (50–70%)

This discrepancy *could / may / might* be the result of contamination. (50–70%)

Could this interaction be the cause of this discrepancy? (50–70%)

NOUNS

In all *likelihood / probability* x = y. (90%)

This raises *the possibility* that x = y. (50–70%)

These results are consistent with the *possibility* that x = y. (50–70%)

ADJECTIVES

It appears *possible / probable / feasible* that x = y. (50–70%)

ADVERBS

X is *unlikely* to play a role in Y. (80–90%)

X is *probably / likely* equal to Y. (80–90%)

Possibly, X is not equal to Y. (50–70%)

X could *possibly / conceivably / plausibly / ostensibly* play a role in Y. (50–70%)

9.7 Anticipating alternative interpretations of your data

If you want the referee and readers to accept your specific interpretation of your data, you will be more convincing if you also provide alternative interpretations. Basically you are anticipating any objections that they might have - you are playing the devil's advocate with yourself.

Let us imagine that you have stated that 'Our findings show that dogs are more intelligent than cats'. Below are some ways to hedge your claim by setting out an alternative interpretation.

S1. *Of course*, the *opposite* may also be possible. *In fact, it cannot be ruled out* that certain species of cats, for example, Siamese, show intelligence traits that are remarkably similar to those of dogs.

S2. *Other factors* besides intelligence *could be involved*, such as the visual and olfactory senses. *This implies that*, in a restricted number of cases, cats could be considered as being more intelligent ...

S3. It may be *premature* to reach such conclusions, and *clearly* there may be *other possible interpretations* for our findings. *However*, we believe that our findings are evidence of ...

S4. *We do not know the exact reasons for the discrepancy* between our findings and those of Santac [2013], but *it might reflect* ... Feeding habits may favor intelligence, *or* they may simply be ... , *or* they may result from ... Future work will be devoted to investigating these three *alternative possibilities*.

S5. *Despite* this apparently clear evidence of the superiority of dogs, our findings are in contrast with those of Karaja [1999] and Thanhbinh [2012], whose experiments with Singapura and Sokoke cats apparently showed that both these species were superior to Rottweilers in terms of emotional intelligence. *However*, we believe that the species of cats involved are quite rare, and that Rottweilers were not a good choice of comparison.

S5 is an example of where you call into question the validity of a possible opposition to your findings (Sect. 8.10).

9.8 Telling the reader from what standpoint you wish them to view your data

Rather than using expressions such as *in our view* and *we believe*, which clearly express your point of view, you can tell the reader from which standpoint you want them to interpret or judge your data. Here are some examples:

Viewed / Seen in this way, the data take on a different meaning.

From this alternative perspective, these findings shed new light on ...

From an X point of view, the results can be interpreted very differently

From such a standpoint, our data assume a very different significance.

In this view, these data may mean that ...

Under these conditions, it is legitimate to pose a new *perspective* on ...

This technique has the effect of distancing you from your own data, and it may help to increase your credibility.

A similar approach is to make the data (or method, model, discussion, hypothesis etc.) the subject of the sentence, with no possessive adjective (i.e. no *our* or *my*), as highlighted in these examples:

These *data* indicate that ...

The *evidence* favors the conclusion that ...

The *model* predicted that ...

From this *discussion*, it would appear that ...

The *hypothesis* seems plausible because ...

The *existence* of such phenomena may give confirmation of ...

Here the technique is to distance yourself from your data (findings etc.) by taking a neutral stance. It seems as if the data themselves are drawing conclusions, rather

than you drawing conclusions. You give the idea that you are not the only person involved in the discussion, the reader is implicitly somehow involved too. This technique is often used when you are concerned that your claims are not sufficiently important or robust.

Useful verbs in such contexts are *imply, indicate, suggest, point toward, hint at* etc.

9.9 Dealing with the limitations of your research

Dr Maggie Charles, Tutor in English for Academic Purposes at Oxford University Language Centre, explains the importance of admitting limitations, but doing so in a way that does not undermine your credibility:

> As a young researcher you want your scientific community to see you as credible, professional and honest, and also reasonably modest. This means that you can, and should, draw attention to limitations in your research. The community needs to know what went wrong in your research, not just for ethical reasons, but also so that others can learn from your 'mistakes'. It also means that others will see you as a reliable and honest researcher. In fact, because you have drawn attention to the problems you have had in your research, the community is more likely to accept the validity and reliability of what you describe in your paper.
>
> However, you can present these limitations in such a way that you do not have to take direct responsibility for them. You can do this by using impersonal forms. These impersonal forms distance you from the limitations of your study and at the same time they highlight for the community that you can evaluate your 'performance' in accordance with the standards of that community.

In the rest of this subsection are some examples of impersonal forms that are commonly used. The passive form is very useful when you don't want to assume complete responsibility for what you are saying. This is because no agent is necessary with a passive.

It was found that the containers for the samples had become contaminated.

This fraction *is assumed* to originate from ...

It *might be speculated* that ...

Another solution, is to use an adverb. In the example below, *regrettably* could be replaced by *unfortunately* or *disappointingly*.

Regrettably, the containers for the samples had become contaminated.

Impersonal phrases beginning with *it* have the same function:

It is regrettable that the containers had become contaminated as this meant that …

It is reasonable to hypothesize that ...

It appears possible that ...

These three tactics give the reader the impression that the responsibility for the contamination does not rest entirely with the author. The author does not explicitly state who is doing the assuming, speculating, hypothesizing etc. This means that you can avoid losing face and so not be perceived as being incompetent. For more on this topic see Sects. 17.12 and 17.13.

9.10 Saving your own face: revealing and obscuring your identity as the author in humanist subjects

In natural sciences, authors often adopt an objective stance by writing in an impersonal fashion. Writers in social and political sciences, on the other hand, tend to have a more personal construction of reality and thus may use the first person to persuade the reader towards their opinion.

Compare for example:

S1. *I argue* that the way 18–21 year-olds vote is influenced more by the physical appearance of the candidate than the candidate's particular political ideas.

S2. *The present study / This paper argues* that the way 18–21 year-olds vote is not uniform.

In S1, the author is stating something that may go against what other authors have previously claimed and she decides to use the first person to show that this is clearly her idea. She is saying: "I may be wrong about what I am saying. My research may not be sufficiently robust to support this idea – and this is my responsibility. So, don't worry if it contradicts what you think." By doing this she helps / hopes to make her claim more readily acceptable to the community and therefore gain credibility in her field.

Using phrases such as *I argue* is what is known as authorial voice. In many languages such a device is not used and it may sound strange, unnatural or even unimportant for you to use it. However, your decision should be based on of the style permitted in your journal and the expectations your referees and readers, rather than necessarily what would be expected in your own language.

In S2, the author is perhaps making a claim that is less controversial or already has some support in the community. Note that the verb *argue* could be replaced by *suggest, propose* or *hypothesize*.

Other verbs you could use in this context are: *infer, calculate,* and *believe*.

You can also use nouns for the same purpose:

Our *interpretation* of these results is ...

My *perspective* on these findings is ...

9.11 Saving other author's faces: put their research in a positive light

It is fine to question other people's findings and conclusions. Even the most reputable papers sometimes include poor research. But when you do make criticisms, ensure that you always do so in a constructive way that still manages to put the original research in a positive light. In this way you save the original author's face, i.e. their reputation and position in the academic world.

Let's imagine that so far in the literature one hypothesis, H1, has been proposed as an explanation for a certain phenomenon *x*. You are proposing a different hypothesis, H2, which completely contradicts H1 and proves it to be wrong. You don't want to be overtly critical of H1, because the referee of your paper could even be the person who initially proposed H1, or at least is a big supporter of it. Equally importantly, readers will more readily accept your objections if you phrase them in a constructive way.

When you need to criticize H1, you need to do so in a way that saves the other author's (i.e. the proposer of H1) face. You can do this by providing an explanation, on their behalf, of why H1 seemed to be the right interpretation. Below are some of the types of phrases you could use:

> Since H1 was originally proposed, a lot of new data on *x* has been presented in the literature (Smith et al. 2010, Burgess 2011). This data would seem to indicate that …
>
> The formulation of H1 was based on a much smaller sample size than in our study. In fact H2 is based on a sample size that is 4-fold greater than …
>
> When proposing H1, the author admitted that the quantity of *x* may have been influenced by *y*. On this basis, we decided to investigate the impact of *y*, and in fact found that …
>
> In her conclusions, the author of H1 recommended that longer follow-up times might lead to more conclusive evidence of *x*. This is why in our study we …

Note that the phrases above do not undermine the credibility of the proposer of H1 and at the same time they guide your readers towards your proposition (see Sect. 8.10).

You will find that link words such as a*lthough, however* and *moreover* may help you to structure your criticism. However, do not use them too often as otherwise the tone of criticism may become too negative.

You should also consider the cost to you of not drawing the readers' attention to some problems inherent in the work of other authors. If you don't draw their attention, will it really affect your argumentation?

9.12 Saving other author's faces: say their findings are open to another interpretation

Another way to indirectly call into question another author's findings is not to say that anything specifically wrong with their findings. You simply say that these findings are open to another interpretation (i.e. your interpretation).

> From our investigations we conclude that the data of Negovelova [2011] can be seen in a different light when the effects of hydrogen are seen in conjunction with ...
>
> It would not be implausible to analyze Hedayat's data from an entirely different point of view. In fact, our analysis reveals that ...
>
> Budinich's findings could also be interpreted as evidence of ... Viewed in this way, Budinich's results are actually in agreement with ours.

The last example shows how you can use data that initially appeared to contradict your data to actually give support to your interpretation.

9.13 Don't overhedge

It is of course possible to overhedge, and become vague and unsure. This is not a good approach. Professor Tony Leggett, Nobel prize winner in Physics, spent many of his early academic years in Japan, and has these comments about the Japanese style of writing.

> Ways of saying things which make sense against a Japanese background may either be nonsense or give quite the wrong impression when interpreted against a Western European one. For instance, if you state a conclusion tentatively or indefinitely, a Japanese reader will understand that this is because you do not wish to be too blunt or assertive, but a European reader will often conclude simply that you are not really sure about it.

Leggett is not criticizing the way Japanese write, but just that the Japanese are reluctant to appear assertive when giving their opinions. What he is saying is: what would be considered perfectly acceptable in your native language, for example imprecise or ambiguous expressions in order to be polite, may not be so acceptable in English and may be considered too inexplicit.

In any case, be careful not to follow a strong positive assertion with a weak statement that undermines it (S1), and avoid having several levels of hedging (S2).

S1. *It is *clear* that yellow *may* be preferable to red for alerting danger.

S2. *It *may* thus, *given* these particular circumstances, be *assumed* that there is a *certain possibility* that yellow *may* be preferable to red for alerting danger.

In S1 *may* weakens the force of *clear*. In S2 four hedging words have been used, which gives the idea that the authors are not at all sure of what they are talking about. S1 and S2 could be revised as S3 and S4, respectively:

S3. It is clear that yellow *is* preferable to red.

S4. In these particular circumstances yellow *may be* preferable to red

9.14 Hedging: An extended example from a Discussion section

The following is an example from the Discussion section of a paper entitled *The Archeology of Water in Gortyn*, by archeologist Elisabetta Giorgi. Her research has revealed what she believes to be a new perspective on Roman aqueducts. She takes the specific case of Gortyn, the most important Roman town on Crete. Until now it was believed that the basic function of the aqueducts in the Roman period of history was to transport water into towns for use by individual citizens in their homes. However, Elisabetta hypothesizes that the main function may have been to provide water for fountains and thermal baths. There are no Romans around today who can confirm her hypothesis, so she cannot be 100% sure of the validity of her findings. Consequently, she 'hedges' her claims, as you can see in the parts highlighted in italics.

> We calculated that the minimum amount of water supplied was around 7,000 m^3 per day. On the basis of demographic estimates for that century, people (1) *may have consumed* from 25 to 50 l per day. (2) *Yet* our calculations show that, if thermal baths and fountains are not taken into account, approximately 280 l per head (3) *could have been pumped* into the town. This figure is 30 l per day higher than the daily average consumption of a post-industrial European country such as Italy.
> The quantity of water that flowed along the aqueduct (4) *thus* (5) *appears to have been* much greater than was needed by the population living in Gortyn, which has been estimated as being around 25,000 [ref.]. Therefore the aqueduct was (6) *probably* built not exclusively to provide drinking water for the citizens. Other authors [ref.] contend that Roman citizens may have had running water in their houses and they cite findings at Pompeii as evidence of this. (7) *However*, our previous archeological research [ref.]. into aqueducts in other Roman towns (8) *would seem to* indicate that the aqueducts were not (9) *necessarily* built for the benefit of common citizens. (10) *In fact*, there were many cases where citizens built their own private wells and cisterns even after the construction of the aqueduct [ref.].

Elisabetta uses four types of hedging devices. The numbers below refer to the numbers in the text.

MODAL VERBS

may have + past participle (1) indicates a probability that Elisabetta is not 100% sure about, but she proposes it as being a reasonable calculation based on her (and / or others') studies of demographics.

could have + past participle (3) refers to a past capacity that she assumes would have been possible.

LINK WORDS

yet (2) means that despite the estimates made in the previous sentence, Elisabetta has evidence that may contradict these estimates. *however* (7) has a similar function, as again Elisabetta is contesting previous research.

thus (4) and *in fact* (10) are used by Elisabetta to provide further support for what she has just said. They guide the reader in following Elisabetta's gradual build up of logical evidence.

VERBS THAT INDICATE UNCERTAINTY

appears to have been (5) and *would seem to* (8) are used to precede findings that Elisabetta wishes to propose to her community. She is a young researcher and is taking a modest approach, she doesn't want to irritate the referees or readers by appearing too presumptuous. Although (5) uses the present tense and (8) uses the conditional, in reality there is only a minimal difference - the conditional just adds another 10% of softening!

ADVERBS

probably (6) and *necessarily* (9) are both used to qualify the verb *built*. Elisabetta uses these adverbs to soften the impact and implications of what she is saying. Again, she is protecting herself from possible criticism by other authors and from future research that might invalidate her theories.

Elisabetta concludes her discussion by providing evidence that the Romans could have built the aqueduct much earlier if they had wanted to, and that the real reason for the aqueduct was to supply thermal baths and monumental fountains, and to irrigate fields.

Our findings (11) *suggest* that the aqueduct in Gortyn cannot have been built earlier than the second century AD. In fact, archaeological data show that many cities, like Gortyn, had a high standard of urban, social and political life even before the Roman age.

(12) *There is thus evidence* that the aqueduct only became necessary when "Rome" decided to transform Gortyn into a Roman provincial capital, which entailed Gortyn having thermal baths, monumental fountains, theatre, amphitheatre and well-irrigated and cultivated land to supply its inhabitants.

(13) *We believe that* the present findings (14) *might help* to reassess the real effect of the Roman aqueducts on the local water supply systems and their role in the daily life of the urban populations.

(15) *To the best of our knowledge,* this is the first time that …

In the above text, Elisabetta uses a series of non-assertive verbs and soft introductory phrases in an attempt to gain credibility in her community.

suggest (11) is much less strong than verbs such as 'prove' or 'demonstrate'.

There is thus evidence (12) - this phrase manages to disassociate the author, Elisabetta, from her findings. Rather than saying *we revealed that the aqueduct only became necessary*, she opts for an impersonal expression - *there is*. The idea is to focus the reader's attention on what was found (i.e. the *evidence*) rather than who found it (*we revealed*). She uses *thus* to reinforce the logic in her argumentation.

We believe that (13) is combined with *might help* (14). This is like a double hedge. Elisabetta is making quite a controversial statement that implies a paradigm shift from previous thinking in her field. She uses this double hedge to make her claims seem more tentative.

To the best of our knowledge (15) - Elisabetta again is protecting herself against the possibility that, unknown to her, someone else has already made this finding. If she had begun her conclusion with *This is the first time that* ... the tone would have been too strong, and her proposition would have left no room for doubt.

After she had written her paper I asked Elisabetta how difficult she had found hedging her claims in English. She said:

> In Italian we use hedging devices too, but the problem is that they do not always have a direct equivalent in English. For example, in Italian when we are expressing doubt about something we can use the subjunctive mood. But in English the subjunctive is generally the same as the indicative, thus the sense of doubt that we express in our mother tongue is completely lost when translated into English. In fact the referees reports that I received for my first papers commented that I needed to be more ‘humble’ and less ‘presumptuous’. This means I have had to learn to hedge when I write in English. Initially this was quite hard. However, I have now realized that basically all I have to do is to precede any strong statement with a few soft introductory words that I have learned by reading other archeological papers in my field. It is actually easier than it looks!

9.15 Summary

Anticipate possible opposition by your referees and readers by not saying things too assertively or directly. In practical terms, it is not difficult to insert ‘we believe’ and ‘might’ when describing key findings that could be interpreted in different ways. And if by using these hedging devices you increase your chances of having your paper accepted in a journal located in the USA or UK, then you should use them!

- Tone down verbs, adjectives, adverbs and your general level of certainty.
- Be aware that the ways you express uncertainty may simply not translate into English.
- Provide alternative interpretations of your data.
- Tell the reader from which standpoint you want them to interpret or judge your data.
- Use impersonal forms to distance yourself when interpreting your findings.
- Save your face by writing in an impersonal fashion.
- Try to put the work of authors in a positive light. If appropriate say their work is open to another interpretation (i.e. yours).
- Don’t overhedge.
- Consider getting help from a native speaker when hedging your claims.

Note: There may be occasions when you really want to convince the referee that your hypothesis is essentially the only interpretation, i.e. you don’t want to give the idea that there is an element of doubt. To learn how to deal with such situations, see Sect. 8.9.

Chapter 10
Paraphrasing and Plagiarism

Why is this chapter important?

Conventions regarding exactly what constitutes plagiarism vary from country to country. Plagiarism in its simplest terms means cutting and pasting from other studies and papers. It also means taking credit for work that others have done.

Plagiarism includes plagiarizing your own work. In fact, some journals stipulate that you cannot use more than five consecutive words from another paper that you have written.

If a referee thinks you may have plagiarized other people's work or your own, then there is a very high probability that he or she will recommend rejecting your paper. If you commit plagiarism within your university or institute then you may risk expulsion.

This chapter is designed to help you understand what is and what is not plagiarism, and how to paraphrase other people's work (but always giving a reference).

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_10,

What the experts say

Conventions with regard to what constitutes plagiarism vary in different countries and not infrequently clash with commonly accepted practice in most international journals. It is vital that authors ensure that they credit the originator of any ideas as well as the words and figures that they use to express these ideas. Copying without proper acknowledgement of the origin of text or figures is strictly forbidden. Small amounts of text, a line or two, are usually ignored. Plagiarism includes self-plagiarism, which is, in effect, publishing the same work twice.

Robert Adams, Emeritus Professor of Applied Mechanics, University of Bristol (UK), and visiting professor at the Department of Engineering Science, University of Oxford (UK)

Plagiarism is unacceptable under any circumstances but, despite this universal disapproval, it is one of the more common faults with student papers. In some cases, it is a case of downright dishonesty brought upon by laziness, but more often it is lack of experience as how to properly use material taken from another source. … Plagiarism in professional work may result in dismissal from an academic position, being barred from publishing in a particular journal or from receiving funds from a particular granting agency, or even a lawsuit and criminal prosecution.

Dr. Ronald K. Gratz, Associate Professor in the Department of Biological Sciences, Michigan Technological University (USA), author of "Using Another's Words and Ideas"

In my work as a supervisor I occasionally come across cases of plagiarism. When I confront my students with this issue, most have absolutely no awareness that they have committed plagiarism, so I work with them to explain what is acceptable and what is not, and get them to make revisions.

James Hitchmough, Professor of Horticultural Ecology, University of Sheffield (UK)

10.1 Plagiarism is not difficult to spot

Plagiarism is very easy to identify, particularly in papers written by non-native speakers.

I revise a lot of research papers from my PhD students. Sometimes I read a paragraph that contains a considerable number of mistakes in the English (grammar, vocabulary, spelling etc.) and then suddenly there is a sentence written in perfect English! This immediately makes me suspicious, so I Google the sentence and very frequently discover it comes from a published paper.

10.2 You can copy generic phrases

It is perfectly normal to copy phrases from other people's papers. However, these phrases must be generic. In fact, such phrases should help you to improve your English - see Chap. 19.

Let's look at what you can paste from another paper.

Here is an example from the literature review of a very interesting paper entitled *International scientific English: Some thoughts on science, language and ownership* by Alistair Wood of the University of Brunei Darussalam. In the extract below Wood talks about different styles of scientific writing around the world and how non-native authors may be at a disadvantage with respect to native authors.

Let's imagine that you work in the same field of research as Wood. I have highlighted phrases in italics that would be perfectly acceptable to paste into your own paper. In fact, these phrases are completely generic.

> *In fact* there is some cross-linguistic contrastive research *to suggest that* the foreigner is *at a disadvantage*. *Even where* the grammar and vocabulary *may be perfectly adequate*, *it seems to be the case tha*t a non-native *may tend* to transfer the discourse patterns of her native language to English. *It has been suggested, for example, that* Asian languages such as Chinese, Japanese and Korean have different patterns of argument to English [3]. Thus *one study found that* those Korean academics trained in the United States wrote in an 'English' discourse style, while their colleague who had trained and worked only in Korea, with *a paper published in the same anthology*, wrote in a Korean style *with no statement of purpose* of the article and a very loose and unstructured pattern *from the English point of view* [4]. *More generally* Hinds *has put forward* a *widely discussed position that* Japanese has a different expectation *as to the degree of* involvement of the reader *compared to* English, with Japanese giving more responsibility to the reader, English to the writer [5].
>
> *It might be objected though that* this is relevant only to languages and cultures which *differ greatly to* English. *However*, research on German *has shown* that German academic writing

> in the social sciences has a *much less linear structure* than English, *to the extent that* the English translation of a German textbook was criticized as haphazard or even chaotic by American reviewers, *whereas* the original had received no such reviews on the European continent [6]. Academic respectability in English *is evidenced by* the appropriate discourse structure but in German *by the appropriate level of abstraction* [7]. *Similarly*, academic Finnish texts *have been shown to* differ in the way they use connectors and previews and are much less explicit than English in their *drawing of conclusions*. Spanish also has *a similar pattern* [8]. English, *therefore, would seem to be a more* 'writer-responsible' language *than at least some other* European languages.

Note how none of the phrases in italics contain unique information. The phrases could be used in many other contexts.

The above extract is also a good example of how to write a literature review (Sect. 14.1).

10.3 How to quote directly from other papers

If you use any of the parts of Wood's text that are not in italics without any acknowledgement you are committing plagiarism.

Let's imagine you wanted to quote from the last line of Wood's paper, which concludes as follows:

> The owners of international scientific English should be international scientists not Englishmen or Americans.

You can cite the exact phrase or sentence used by putting it in quotations marks. Then reference the author.

> As noted by Wood [1997]: "The owners of international scientific English should be international scientists not Englishmen or Americans".

As an alternative to *As noted by Wood [1997]* you could say:

> Wood [1997] concludes:
>
> As Wood [1997] states:
>
> As Wood states in his 1997 paper:
>
> In his Conclusions, Wood [1997] writes:

How you make the reference to Wood's paper will obviously depend on your journal's style.

Putting quotation marks (" … ") around an unaltered sentence and giving the proper citation for the origin of the work does not technically constitute plagiarism. But it may indicate to supervisors and referees that you have not actually understood what you have written – it is not your own work.

The following comment comes (with his permission!) from Dr Ronald K. Gratz's online article *Using Another's Words and Ideas*. This article is essential reading and can be downloaded from the link given on page 311.

> It is important that you understand the work you are using in your writing. Quoting someone's sentences does not necessarily require this understanding. On the other hand, you must understand the author's meaning if you are going to be able to paraphrase correctly. This is not to say that one should never quote a reference exactly. Exact quotes have value when it is important to give the precise wording used by the original author. It is unacceptable when it is used to make up the bulk of a paper, or of a part of a paper. It is also unacceptable when it is used to avoid the work of putting the ideas into your own words.

However, using quotation marks is acceptable when you are reporting another's author's definition or a philosopher's statement.

10.4 How to quote from another paper by paraphrasing

Rather than quoting directly, you can paraphrase Wood's sentence using your own words. But you must still reference Wood, otherwise it would appear that these are you own conclusions. S1 is Wood's original sentence, S2 and S3 are paraphrased versions.

S1. The owners of international scientific English should be international scientists not Englishmen or Americans.

S2. International scientific English belongs to everyone in science [Wood, 1997].

S3. International scientific English does not just belong to native English speakers but to the whole scientific community [Wood, 1997].

Let us now compare the versions.

	WOOD'S ORIGINAL VERSION (S1)	PARAPHRASED VERSIONS (S2 AND S3)
(1)	owners	belongs
(2)	International scientific English	International scientific English
(3)	international scientists	everyone in science the whole scientific community
(4)	not Englishmen or Americans	not just … native English speakers

Below is an analysis of the four items in the table.

(1) Wood uses a noun, the paraphrased version (PV) uses a verb. Switching parts of speech (e.g. noun to verb, noun to adjective) is a great way to paraphrase and 'disguise' the original.

(2) The only item in Wood's sentence that has not been paraphrased is *international scientific English* (ISE). This is because ISE is not an expression that was coined (i.e. used for the first time) by Wood. It is a recognized expression that people in the field of teaching English as a foreign language will be aware of.

(3) Wood uses a noun that refers to a person (*scientist*), the PV uses the root word (*science*) and the adjective (*scientific*). This method of using the same root, but changing the part of speech is very common. A similar combination would be: *photographer, photography, photographic*.

(4) Wood made a contrast between two groups of people – all those involved in science (*international scientists*), and just the English and Americans (and by implication, Canada, Australia etc.). The PV changes the focus slightly and interprets this contrast as being between non-native speakers (*international scientists*) and native speakers of English.

Now let's look at another example. This time let's imagine you wanted to paraphrase the first line (S4) of Dr Gratz's comments in Sect. 10.3. S5–S8 are possible paraphrased versions, which are in order of increasing difference.

S4. It is important that you understand the work you are using in your writing.

S5. *It is crucial that you completely understand the works you use in your paper [Gratz 2006].

S6. You must have a clear understanding of the reference papers that you quote from in your own manuscript [Gratz 2006].

S7. If you cite any works by other authors in your own paper, it is vital that you really understand the full meaning of what the other authors have written [Gratz 2006].

S8. Researchers should ensure that they fully grasp the meaning of any of the literature that they cite in their papers [Gratz 2006].

Here is an analysis of the types of changes made in each PV. This should help you see the many devices that can be used in paraphrasing.

S5: *crucial* is a synonym for *important*; *completely* is redundant but is a modification of the original; *work* (singular) vs *works* (plural); the present continuous (*are using*) vs present simple (*use*); *writing* (an – ing form used to indicate an activity) vs *your paper* (a noun). S5 is an example of what Gratz would define as 'unacceptable' (Sect. 8.5) because it is essentially identical to the original. Nevertheless, the devices used (synonyms, change of tense etc.) are very useful when paraphrasing.

S6: the concept of *important* (adjective) has been replaced by *must* (a modal verb); *understand* (verb) vs *understanding* (noun); *works you use in your paper* vs r*eference papers that you quote from in your own manuscript* (three synonyms for three nouns). S6 might still be considered unacceptable by some experts.

S7: the order in which the information is presented in the original is reversed in the PV. Similar devices to those used in S5 and S6 have also been exploited. S7 is, in my opinion, an acceptable paraphrase.

S8: the major change here is in the way readers are addressed (*you* vs *researchers*), this factor along with the other changes make the sentences almost unrecognizable

compared to Gratz's original sentence. However, Gratz is still referenced at the end of the sentence. This is because the concept contained in the sentence still 'belongs' to Gratz. S8 is certainly an acceptable paraphrase.

You may be thinking that paraphrasing is a pointless exercise particularly if you quote the original reference to indicate that the concepts contained are not yours. However what I have outlined above is generally considered to be good practice in the international community. In addition, to be able to paraphrase as in S7 and S8 means that you really have to understand the original sentence, which is clearly beneficial for you.

Note also that you may wish to paraphrase your own writing within the same paper, i.e. to not repeat in the Conclusions the same phrases you have used in the Abstract (Sect. 18.3).

10.5 Examples of how and how not to paraphrase

The following examples and explanations are taken from Dr Gratz's article *Using Another's Words and Ideas*. They are more technical than the examples given in Sect. 10.4 and also highlight unacceptable paraphrasing.

S1 is the original version of a sentence from one of Gratz's works, published in 1982.

S1. Bilateral vagotomy resulted in an increase in tidal volume but a depression in respiratory frequency such that total ventilation did not change.

A *vagotomy* is a surgical procedure, and *tidal volume* is the lung volume representing the normal volume of air displaced when breathing in and out. Here are three examples of unacceptable attempts to rewrite S1.

S2. *Gratz (1982) showed that bilateral vagotomy resulted in an increase in tidal volume but a depression in respiratory frequency such that total ventilation did not change.

S3. *Gratz (1982) showed that bilateral vagotomy produced an increase in tidal volume and a depression in respiratory frequency so that total ventilation did not change.

S4. *Gratz (1982) showed that following vagotomy the snakes' lung volume increased but their respiratory rate was lowered. As a result, their breathing was unchanged.

S2 is identical to S1 except that the author is attributed. A couple of words have been changed in S3, but this does not alter the fact that S3 is still substantially the same as S1.

S4 is more serious because the paraphrased version has attempted to find synonyms for key technical words: *lung volume* is not the same as *tidal volume*, and *breathing*

is not the same as *total ventilation*. Moreover, dropping the adjective "bilateral" alters the sense of the experimental technique.

S5 is what Dr Gratz would consider as an acceptable paraphrase of his sentence. Although the same information is presented, the sentence structure and word order have been substantially altered.

S5 Gratz (1982) showed that following bilateral vagotomy the snakes' tidal volume increased but their respiratory frequency was lowered. As a result, their total ventilation was unchanged.

10.6 Paraphrasing the work of a third author

Another case is where you want say the same thing as another author (Wood, in S1), regarding a finding that does not belong to Wood but to a third author's work (Hinds, in S1) which Wood refers to. In this case Wood is discussing the literature, rather than his own personal ideas.

S1. More generally Hinds has put forward a widely discussed position that Japanese has a different expectation as to the degree of involvement of the reader compared to English, with Japanese giving more responsibility to the reader, English to the writer [Ref 5].

You could paraphrase S1 as follows:

S2. Many authors, for example Hinds [Ref 5], have proposed that the level of expected reader involvement in Japanese writing is higher than in English.

S3. It is generally accepted that Japanese writers expect their readers to be more involved than do English writers [Ref 5].

S2 retains the name of the author mentioned by Wood. S3 is stronger and suggests that what Hinds originally proposed has now become generally accepted (an alternative expression is *it is well known that*). This is commonly the case. In fact, Wood's article was published in 1997, since then several other papers and books have been published on the topic, which have reinforced what Hinds proposed.

10.7 How to check whether you have inadvertently committed plagiarism

To check whether you have inadvertently plagiarized your own or other people's work, see if your journal offers CrossCheck. This is a service offered by Cross Ref (www.crossref.org). It checks your paper against thousands of others to see whether the same phrase appears in someone else's work.

10.8 Summary

- Plagiarism is a serious issue in international science, even though it may not be considered so in your country of origin. It is easy for native speakers to spot it in the work of non native speakers. If you commit plagiarism your credibility and reputation will be seriously compromised. If you not sure whether you have plagiarized your own or someone else's work, use CrossCheck
- Copying phrases from other people's work is perfectly acceptable and is a good way to learn useful phrases in English that you can then use in your own work. However, such phrases must be 100% generic in the sense that they hold absolutely no hard information
- Use direct quotations sparingly. The problem is that the referee (or your professor) cannot be sure that you have fully understood the quotation
- Typical ways to paraphrase:
  - use of synonyms for non key words (especially verbs, adverbs and adjectives)
  - change of part of speech, for example: from noun to verb, from noun to adjective, from one category of noun to another category of noun (e.g. *science* to *scientist*)
  - change of nouns and pronouns from singular to plural and vice versa
  - change of verb form, for example: from *–ing* form to infinitive, from simple to continuous, from active to passive
  - change of style from personal to impersonal
  - reversal of the order in which information is presented
- Never paraphrase technical words
- If the original contains ideas that in some sense 'belonged' to the original author, then this author should be acknowledged. This is true even if you have radically changed the original so that it is now unrecognizable
- When quoting the work of a 'third' author, cite the reference to that third author's paper

Part II
Sections of a Paper

Chapter 11
Titles

What key skills are needed when writing a Title?

Browsers on the Internet looking for a paper may read hundreds of titles before they select an Abstract to read. According to one of Britain's top editors, writing good headlines represents about 50% of the skills vital to article writing. For this reason the gurus of research writing tend to dedicate more pages to discussing the importance of the title than they do to any section in the paper itself.

Every word in your title is important. So the key is to devise a title that:

1. will immediately make sense to the referee
2. will easily be found by a search engine or indexing system
3. will attract the right kind of readers rather than discouraging them, and will also catch the attention of browsers. Note 'attraction' does not mean resorting to newspaper-like headlines, but simply containing those words that readers in your field would expect to find
4. does not consist of a string of nouns and will be immediately comprehensible to anyone in your general field
5. is short
6. has a definite and concise indication of what it is written in the paper itself. It is neither unjustifiably specific nor too vague or generic

The rules for writing good titles reflect the rules on writing skills in Part 1 of this book.

Note that all the rules relating to titles given in this chapter are also valid for headings, subheadings, and legends / captions. They are also valid for book titles and chapter titles.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_11, © Springer Science+Business Media, LLC 2011

Typical complaints of Referees

The title is too generic ("A general strategy"…): it should be more informative of the content of the manuscript (e.g. A procedure for the extraction of vitamin B from ….)

This manuscript is of sound science but there are a few problems with how it is written. The title is rather misleading: it mentions a specific pathology in a specific fruit (kiwi). However, the focus of the paper is on the pathology, the aspect of it being in kiwi seems secondary. An alternative title, which omits kiwi, would be …

As it stands, the title is just a sequence of nouns. I only understood the meaning of the title after I had read the abstract and introduction.

11.1 How can I generate a title?

Think about the following questions:

- What have I found that will attract attention?
- What is new, different and interesting about my findings?
- What are the 3–5 key words that highlight what makes my research and my findings unique?

On the basis of your answers you should be able to formulate a title.

11.2 How can I make my title more dynamic?

Every word (apart from articles and prepositions) included in the title should add significance. The following words in italics rarely add value.

S1. **A study of* the factors affecting the trihyroxyindole procedure for the analysis of deoxyribonucleic acid

S2. **An investigation into* some psychological aspects of English pronunciation

The first seven words in S1 give the reader no information. S1 and S2 might be more dynamic and more concise if the initial redundant words were removed.

S3. Factors affecting the trihyroxyindole procedure for the analysis of deoxyribonucleic acid

S4. Some psychological aspects of English pronunciation

Similar words that are often redundant are: *inquiry, analysis, evaluation,* and *assessment.*

However, words such as *study* and *investigation* may be useful to make your research sound less conclusive. S5 sounds like the authors have made the definitive study (i.e. the final settlement or decision) of customer satisfaction, whereas S6 sounds less arrogant and more open.

S5. *The determinants of customer satisfaction

S6. An investigation into the determinants of customer satisfaction

However, simply replacing *the* with *some* (S7) or removing it completely (S8) would also make the research seem less definitive.

S7. Some determinants of customer satisfaction

S8. Determinants of customer satisfaction

Another occasion where words such as *study* and *investigation* may be useful is in two-part titles. For example:

S9. Old age: A study of diversity among men and women

However, S9 might have more impact as follows:

S10. Old age: diversity among men and women

S10 could also be rewritten as a question.

S11. What factors effect diversity among men and women in old age?

But S11 still contains redundancy and is not particularly eye-catching. Better might be:

S12. Will women always live longer than men?

11.3 Can I use my title to make a claim?

Many referees and journals editors do not appreciate authors who use the title to present their major conclusion and thus perhaps overstate the importance of their findings. For example:

The consumption of one apple per day precludes the necessity of using medical services

The above is what is known as a declarative title. It summarizes the author's most important findings, as a complete sentence (i.e. with subject – verb - object). It does so in a way that there seems to be no element of doubt. However, if the author's conclusions are only speculations, then such declarative titles are dangerous. This is because they give readers the initial idea that the issue has been settled and that what the author asserts is now scientific fact.

Such titles are increasingly common in medicine and biology, and may be acceptable if well documented. Such titles also get your paper noticed and potential readers may thus become stimulated into reading your paper. The important thing is to ensure that the title reflects the truth and is supported by the rest of the paper.

Before using a declarative title check with other titles in your chosen journal.

11.4 Are questions in titles a good way to attract attention?

The titles below highlight that a question can be formulated using an auxiliary (e.g. *does, would, can, will*) and using question words (e.g. *why, when, what, which, why, who*).

Does the ocean-atmosphere system have more than one stable mode of operation?

If homo economicus could choose his own utility function, would he want one with a conscience?

Why Do Some Countries Produce So Much More Output Per Worker Than Others?

When do foreign-language readers look up the meaning of unfamiliar words? The influence of task and learner variables

What do bosses do? The origins and functions of hierarchy in capitalist production

Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus.

Titles with questions also work particularly well for abstracts submitted to conferences. They are generally much more informal and because of their question form they immediately get readers thinking about what the answer might be. They can also be original and fun, as highlighted by the last title. They thus tend to stand out from other titles and are more likely to attract attention.

11.5 When is a two-part title a good idea?

The fifth and sixth titles in Sect. 11.4 are examples of a two-part title. In these cases the first part poses a question, which the second part answers.

In other cases the second part acts as an explanation for the first part:

> Consequences of erudite vernacular utilized irrespective of necessity: problems of using long words needlessly
>
> The role of medicine: dream, mirage or nemesis
>
> Telling more than we can know: Verbal reports on mental processes

Given that two-part titles are much less common than other titles they generally attract more attention, and like questions work well for abstracts submitted to conferences.

11.6 How should I punctuate my title?

The two parts of the titles in Sect. 11.5 are separated by a colon. Some journals require a capital letter after a colon, as in the last example.

Titles never end with a period (.), but if they are questions, then there should be a question mark at the end (see examples in Sect. 11.4).

11.7 What words should I capitalize?

There are basically two ways to capitalize a title. The first is to capitalize each initial letter, apart from articles (*a, an, the*) and prepositions (e.g. *on, by, in, of*). You can see examples of this in Sect. 11.8.

The other is just to capitalize the first letter of the first word, and then to have all the other words in lower case. Of course, if the word is a proper noun, then this should have an initial capital letter too. You can see examples of this in Sect. 11.5.

Check which system is used in your chosen journal.

11.8 What types of words should I try to include?

Where possible use the *-ing* form of verbs rather than abstract nouns. This will make your title more readable as well as making it 2–3 words shorter.

ABSTRACT NOUNS	VERBS
The *Specification* and the *Evaluation* of Educational Software in Primary Schools	*Specifying* and *Evaluating* Educational Software in Primary Schools
Methods for the *Comparison* of Indian and British Governmental Systems in the 19th century	Methods for *Comparing* Indian and British Governmental Systems in the 19th century
A Natural Language for Problem *Solution* in Cross Cultural Communication	A Natural Language for *Solving* Problems in Cross Cultural Communication
Silicon Wafer Mechanical Strength *Measurement* for Surface Damage *Quantification*	*Quantifying* Surface Damage by *Measuring* the Mechanical Strength of Silicon Wafers

The key words in your title are likely to be nouns. So choose these nouns very carefully. The key words in the first title above are *educational software* and *primary schools*.

Try to choose adjectives that indicate the unique features of your work, e.g. *low cost, scalable, robust, powerful*. Adjectives such as *reliable* should only be used if work in your field has so far only produced an unreliable system or unreliable results.

11.9 What other criteria should I use to decide whether to include certain words or not?

You can use an Advanced Scholar Search to check how frequently a word in your title is used. Under the form 'Find articles' insert your word or combination of words into the 'with the exact phrase' field. Then in the 'where my words occur' field, choose 'in the title of the article'.

Let's imagine that you want the readers to know how great your research is and you want to choose an adjective, such as the ones in the table below, to emphasize the importance of your work.

ADJECTIVE	NUMBER OF RETURNS
cutting edge	6,500
innovative	100,000
novel	550,000
new	130,000

The above table could be interpreted as indicating that the lower the number of returns, the less frequent the adjective is and therefore the more noticeable it is.

If the word you choose gets less than a few thousand returns and it is not a specifically technical then you should check whether the authors:

- are native speakers
- use the word in the same way and in the same kind of context as you do

If the answer to either of the above is 'no', then you need to think of another word.

For example, the title below may make sense in the native language of the author, but when translated into English it sounds rather strange:

> A study on the use of oils and colorants in Roman cosmetics: a witness of make-up preparation

The problem word is *witness*, which is here being used to mean *evidence* or *example*. A search on Google Scholar for "a witness" only gives 1,300 returns, which is very low given that the concept of evidence and examples is very common in research. Also, a quick look at the titles in which the term *witness* appears quickly indicates that *witness* is generally confined to a legal context meaning someone who sees something, it thus refers to a human subject whereas make-up is inanimate. You can also see words in context on wordnik.com.

11.10 Will adjectives such as *innovative* and *novel* attract attention?

What the table in Sect. 11.9 also indicates is that the titles of many millions of other papers do not have such adjectives in their titles. This is because the other words in the title should enable readers to understand whether your work is innovative or not, without you having to use *innovative* and *novel* to tell them so.

The problem with *novel* and *innovative* is that they give no indication as to how something is novel. For example, what does *novel* mean in the following title?

> A novel method for learning English

If your research is not novel then no one would want to read about it anyway. You need to explain to readers what makes it novel. More explicit adjectives to replace *novel* could be: *computerized, guaranteed, high-performance, low-cost, minimal-stress, no-cost, pain-free.*

Finally, no one is likely to include the words *novel* or *innovative* when Googling papers in their field.

11.11 How can I make my title shorter?

Titles are often constricted by the number of characters that can be used (check with your journal to see how many words or characters you can use). In some cases you can keep your title as it is but reduce it in length simply by replacing the non-key words with shorter synonyms.

LONG VERB	SHORT VERB	LONG NOUN	SHORT NOUN
achieve	gain	advantages	gain, benefits, pros
apportion	allot	examination, investigation	study
calculate, evaluate	assess, rate	improvement	advance
demonstrate, display, exhibit	show	modification	change
determine	fix	LONG ADJECTIVE	SHORT ADJECTIVE
facilitate	ease	accurate	exact
guarantee	ensure	fundamental	basic
prohibit	block	important	key, top
require	need	innovative	novel, new
support	aid	necessary	needed
utilize	use	primary	main

The most obvious ways to make your title shorter are to:

- choose the shortest word (for more examples see Sect. 5.8)
- remove redundant words (see Sect. 5.3)
- use verbs rather than nouns (see Sects. 5.4 and 5.5)

11.12 Is it a good idea to make my title concise by having a string of nouns?

The title in S1 is almost incomprehensible for a reader.

S1. *Cultural heritage audiovisual material multilingual search gathering requirements

However, for the author S1 will be perfectly clear. You, as an author, know exactly what your title means and so for you it does not seem a problem to put lots of nouns together with no prepositions or verbs. Some of my students have even told me that it to them it seems "more English and more elegant". This is simply not the case. A much clearer version of S1 is S2.

S2. Gathering requirements for multilingual searches for audiovisual materials in the cultural heritage

Below are some more examples.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Educational software specification definitions trends	Trends in defining the specifications for educational software
Examining narrative cinema fiction and fact boundaries	Examining the boundaries between fiction and fact in narrative cinema
New archaeological research and teaching technologies	New technologies for research and teaching in archaeology

What the RVs highlight is that the order of the nouns has been reversed. In the OVs there is a series of nouns that premodify (describe) the final noun. However, these final nouns (*trends, boundaries, technologies*) are not usually used in English in combination with another noun.

Melanie Bell, who researches English language at the University of Cambridge, comments:

> Although native speakers string nouns together, especially when coining terms in technical language, it's probably safer to avoid creating multiword compounds of more than two, or perhaps three, words. English tends to be clearer if nouns are not used in a long string but are broken up by the use of prepositions and verbs that show how the nouns are related to one another.

The OVs are examples of concatenations of nouns, and the RVs represent phrasal options. By 'coining terms' Bell means creating a combination of nouns that has never existed before: *specification definitions trends* and *fact boundaries* are examples of such combinations. The difference between a native speaker and a non-native speaker, is that a native speaker intuitively knows whether a combination sounds right or not, whereas a non-native rarely has this ability. If you are not sure whether a combination exists or not, then check with Google Scholar. If you are combining relatively common words (including technical words) and you don't get at least 100,000 returns, there is a good chance that your combination of nouns does not exist. In such cases you can simply adopt the method highlighted in the RVs. This method involves using verbs (Sect. 11.8) and prepositions (Sect. 11.13).

However, strings of nouns and adjectives must be used if they are names of pieces of equipment or procedures. Here are some examples taken from the Methods section of three papers.

> An Oxford Link SATW ultra-thin window EDX detector
>
> A Hitachi S3500N environmental scanning electron microscope
>
> A recently developed reverse Monte Carlo quantification method

For more on this topic see Sects. 2.14 and 2.15.

11.13 Should I use prepositions?

Most titles of more than about five words require prepositions. The table below explains the typical meanings of prepositions in titles, and gives some examples with and without prepositions.

	MEANING	POOR / INCORRECT ENGLISH	GOOD ENGLISH
by	how something is done	Fast computing machines equation of state calculations	Equation of state calculations *by* fast computing machines
for	for the purpose of	Depression measuring inventory	An inventory *for* measuring depression
from	the origin of	Antonio Gramsci prison notebooks selections	Selections *from* the prison notebooks of Antonio Gramsci
in	where something is located, what something regards	Vertical flux of ocean particles Classical theory of elasticity crack problems	Vertical flux of particles *in* the ocean Crack problems *in* the classical theory of elasticity
of	belonging to, regarding	Reality social construction Model dimension estimation	The social construction *of* reality Estimating the dimension *of* a model
		Cancer causes: cancer avoidable risks quantitative estimates	The causes *of* cancer: quantitative estimates *of* avoidable risks *of* cancer

Even if you don't understand the exact meaning of the above titles, the important thing to note is that the use of prepositions helps the reader to understand how the various elements in the title are related to each other. Also note that rewriting a title so that it contains prepositions may involve adding *a/an* or *the* (see Sects. 6.6 and 11.14). Such cases are underlined in the table.

I have given more examples of the preposition *of* than for the other prepositions because the non-use of *of* tends to create more difficulties for the reader than any other preposition.

Do not worry if you use the same preposition more than once in the same title. For example *of* is used three times in the last title in the table above. This is perfectly acceptable and is not considered bad style in English.

11.14 Are articles (*a / an, the*) necessary?

Although a title is not generally a complete sentence, it does have to be grammatically correct. This means that it must have articles where necessary, even though this will increase the length of the title.

S1. *Survey of importance of improving design of internal systems

S2. A survey of the importance of improving the design of internal systems

S1 is not correct English. A general rule of English is that a countable noun that is in the singular must be preceded by an article. In S1, *survey* is a singular countable noun, so it must be preceded by either *a* or *the*. In S2, *a* is the correct choice because we are not referring to a survey that the reader already knows about. An example of where *the* would be necessary is in S3, which is part of a literature review:

S3. Two surveys on x have been reported in the literature, *the* survey conducted by Williams is more comprehensive than *the* survey carried out by Evans,

In S3, the author is referring to specific surveys, so *the* is obligatory.

Going back to S1, another general grammatical feature of English is that if you have the following sequence of words: *noun1 + of + noun2*, then noun1 is preceded by *the*. This is because noun1 is used to specify noun2. This means that we need *the* before *importance* and before *design*.

The last noun in S1 is countable but it is plural (*systems*) and unspecified (we know that the systems are *internal*, but we do not know which *internal systems* they are). In such cases, no article is required.

No *the* is required for uncountable nouns (i.e. *lack, feedback* and *equipment* in S4–S6).

S4. Lack of protective immunity against reinfection with hepatitis C virus

S5. Feedback and optimal sensitivity

S6. Vibration analysis for electronic equipment

There are some cases where the use or non-use of *the* changes the meaning of the title.

S7. The factors that determine depression

S8. Factors that determine depression

S7 gives the idea that the author has made a comprehensive survey of depression and has identified <u>all</u> those factors that lead to depression. This makes the paper sound like the final word on depression, i.e. this is the definitive article on depression.

S8 is not all-inclusive. The reader will expect to learn about <u>some</u> factors. This makes the paper sound much more modest.

Sometimes the use of *the* does not follow the same rules as in general English. For example, the first word in S9–S11 is a countable noun in the singular and as such would normally require *the*.

S9. Effect of clinical guidelines on medical practice

S10. Influence of education and occupation on the incidence of Alzheimer's disease

S11. Association of exogenous estrogen and endometrial carcinoma

S12. Measurement of protein using bicinchoninic acid

Such non-use of *the* seems to be very common in medicine, biology and chemistry. S9 and S10 could also be written as *The effect of* ... and *The influence of* with no change in meaning.

Given that the rules of the use of *the* are rather mysterious, the best thing to do is to use Google Scholar to compare your draft title with similar titles. For more explanations of the usage of article see Sect. 6.6.

11.15 How do I know whether to use *a* or *an*?

The difference between *a* and *an* in a title follows normal usage.

Use *a* before all consonants, before *eu*, and before *u* when *u* has the sound as in *university* and *unit*.

Use *an* before *a, i* and *o*. It should also be used before *e* except before *eu*, and before *u* when *u* has the sound as in *unusual* and *understanding*. Use *an* before *h* only in the following cases: *hour, honest, honor, heir*. Some authors use *an* before *historical* too.

These rules mean that the following are wrong:

S1. *An hybrid approach to X.

S2. *An unique approach to Y.

S1 should be *a hybrid* (the *h* in *hybrid* is aspirated). S2 should be *a unique*, because the *u* in *unique* is pronounced like *you*.

Note also the words in italics in the following italics:

S3. GNRA tetraloops make *a U-turn*

S4. The evacuation of the Machault, *an 18th-century* French frigate

S5. *An NLP* application with a multi-paradigm architecture

u as a separate letter is pronounced *you*, *18th* stands for *eighteenth* (i.e. beginning with an *e*), and *N* is pronounced *en*.

11.16 Is using an automatic spell check enough?

No, it isn't! The following titles contain spelling mistakes and typos (e.g. inverted or missing letters) that spell checkers are not able to find.

S1. *Incidence of Hearth Attacks and Alzeimer's Disease among Women form East Asia

S2. *An atmospheric tape reorder: rainfall analysis trough sequence weighing

In S1 there are two errors that a spell checker cannot find - *hearth* and *form* (*heart* and *from*). This is because these words exist and will be in the spell checker's vocabulary. Likewise in S2 *reorder, trough* and *weighing* (*recorder, through* and *weighting*) are words that exist.

A spell checker would certainly highlight *Alzeimer's* (S1) as not being correct, but many authors ignore technical words that are highlighted by mistakenly thinking that they are simply not in the spell checker's vocabulary. Often this is the case, but not here. The correct spelling is *Alzheimer's*.

The problem in this case is that you as the author may be incredibly familiar with the title of your paper, it may even have been the title of your Masters or PhD thesis. This means that you are unlikely to check for possible errors. Given that you may not be unable to see your own spelling mistakes, it is a good idea to show your title to several other people, firstly to get them to check the spelling but more importantly to get some feedback on whether your title is clear and explicit enough.

In a research paper, poor spelling gives the idea that you did not make the effort to check your paper. By extension, if you did not check your spelling there is a chance you did not check your data. Perhaps for this reason referees seem obsessed with finding and reporting spelling mistakes. If they find more than one or two this may cause them to recommend that publication of your paper should be delayed until the paper has been thoroughly proof read.

Another major reason for checking the spelling in your title, is that if a key word (e.g. Alzheimer's) is misspelled or not punctuated correctly (note the apostrophe before the *s*), then search engines will not be able to find it.

Here are the returns (in rounded numbers) from Google Scholar for *Alzheimer's*, *Mediterranean*, and *silicon wafer*. The first two rows contain misspellings, the correct version is in the last row.

Alzeimers	1	Meditterranean	15	silicon waffer	5
Alzheimers	1,490	Meditteranean	24	sillicon wafer	11
Alzheimer's	100,000	Mediterranean	13,300	silicon wafer	175,000

These numbers prove the importance of spelling key words correctly to ensure that potential readers find your paper.

11.17 Summary: How can I assess the quality of my title?

- You need to check that your title is:
  - in correct English - in terms of syntax, vocabulary, spelling and capitalization
  - understandable (no strings of nouns)
  - eye-catching and dynamic (through effective use of vocabulary and even punctuation)
  - sufficiently and appropriately specific
  - reflects the content of your paper
  - expressed in a form that is acceptable for a journal
- You can check the syntax and the level of understandability by consulting with a native speaker. Generally speaking titles that contain at least one verb and one or more prepositions tend to be much easier to understand.
- You can check the vocabulary and spelling using Google Scholar. Remember that an automatic spell check is not enough.
- The best way to decide whether it is eye-catching and sufficiently specific is to prepare several titles (including ones in two parts, and in the form of a question) with various levels of specificity and ask colleagues to choose their favorite.
- Unless you get someone to read the whole paper for you, you are probably the best judge of whether your title reflects the actual content of your paper. If it doesn't, the referees will probably tell you.

Chapter 12
Abstracts

What key skills are needed when writing an Abstract?

The key skills are to write an Abstract in a way that will enable:

- editors to make a quick decision on whether the paper is relevant to their journal (without having to read the whole paper) and is thus worth submitting to referees who will then judge the paper in its entirety
- a reader to identify quickly what the paper is about, to judge how relevant it is to their interests, and so to decide whether they should buy / read the whole paper or not. This process is sometimes known as 'screening'
- information managers (e.g. librarians) to put it in their indexes

Online journals have databases of abstracts. Your job as a writer is to 'sell' your abstract to potential readers by:

- attracting their curiosity and stimulating them to want to read the complete paper
- writing very clear and short sentences (max. 25 words, unless the sentence contains a list)

First impressions are very important. If your paper makes a bad initial impression, there is a very strong chance that the reader will quickly stop reading. It will also have a negative effect on referees - if they struggle to read your Abstract or Introduction, this will impact on their reading of the rest of the paper. They will expect the rest of the paper to be difficult too, and may only to look for evidence that confirms this initial impression, even if the rest of the paper is in fact quite readable.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_12,

Typical complaints of referees

The author has written more than 400 words in the abstract and yet has only described the context but not the results of his/her work and the implications.

The abstract doesn't do justice to what the paper is about. It is too abstruse and dense. It is only understandable after the paper has been read. It should be understandable to a general economics-literate audience, not just to those few researchers within the author's very specific field.

The authors have failed to state why the scientific community should be interested in their work nor what value is being added to what is already known.

12.1 What is an abstract? How long should it be?

There are four main types of abstracts, all of which summarize the highlights of your research and all of which will be judged in isolation from the accompanying paper (if there is one). Abstracts are sometimes called Summaries.

Abstracts are found before a full article in a journal, standalone in databases of abstracts, and in conference programs.

UNSTRUCTURED ABSTRACT

A single paragraph of between 100–250 words containing a very brief summary of each of the main sections of your paper

STRUCTURED ABSTRACT

The same as (1) but divided into several short sections (Sect. 12.11).

EXTENDED ABSTRACT

A mini paper organized in the same way as a full paper (e.g. Introduction, Methods, Discussion …), but substantially shorter (two to four pages). Depending on the journal, conference or competition, the extended abstract may or may not include an abstract – for example, it may begin directly with an introduction

CONFERENCE ABSTRACT

Normally a standalone abstract (sometimes up to 500 words), designed to help conference organizers to decide whether they would like you to make an oral presentation at their conference (Sect. 12.13). It may be of any of the three forms above.

The type of abstract you choose and the format to use will depend on the journal or conference. Make sure you read their instructions to authors before you begin writing.

12.2 When should I write the Abstract?

Write a rough draft of the abstract before you start writing the paper itself. This may help you to decide what to include in the paper and how to structure it. But experienced writers always write the Abstract (and often the Introduction too) last, i.e. when they have finished the rest of the paper. This reflects the research process itself - the first thing you write about is what you found, then how this can be interpreted.

In any case, and as with the whole paper, you must have a clear idea of your intended audience.

12.3 How should I structure my Abstract?

An Abstract generally answers at least the first three of the following questions, and generally in the following order. You can use the answers to these questions to structure your Abstract.

- Why did I carry out this project? Why am I writing this paper?
- What did I do, and how?
- What were my results? What was new compared to previous research?
- What are the implications of my findings? What are my conclusions and/or recommendations?

However chemists, physicists, biologists etc. who are presenting some new instrumentation may want to focus not on what they found, but on what the benefits of their apparatus are and how well it performs.

To decide what to include it may help you to go through your paper and highlight what you consider to be the most important points in each section.

The order in which you answer the questions above can make a very different impression on readers. To learn more about this important aspect see Sect. 4.6.

12.4 Formal, natural and applied sciences. How should I structure my abstract? How much background information?

Although the style of an abstract may differ from discipline to discipline and from journal to journal, the structure and information provided is quite similar. The aim is always to tell readers all they need to know to help them decide whether to buy / read the paper.

Below is a fictitious example from an applied science - engineering - and would also be applicable for most formal sciences and natural sciences (as defined by Wikipedia - http://en.wikipedia.org/wiki/Science). The numbering is mine.

> (1) The lifetime of a 4G cellular phone battery may be subject to the number of times the battery is recharged and how long it is charged for. To date, there has not been an adequate analytical model to predict this lifetime. (2) In this work an analytical model is developed which describes the relationship between the number of times a battery is recharged, the length of time of each individual recharge, and the duration of the battery. (3) This model has been validated by comparison with both experimental measurements and finite element analyses, and shows strong agreement for all three parameters. (4) The results for the proposed model are more accurate than results for previous analytical models reported in the literature for 4G cell phones. (5) The new model can be used to design longer lasting batteries.

Below is the structure of the above abstract and the questions it aims to answer. The numbers refer to the numbers in the abstract.

1. The problem that this paper is trying to resolve set in the context of the current situation. Why did you carry out your project and why are you writing this paper? What gap in the current knowledge do you hope to fill?
2. New solution given by authors of the paper. What is the innovative contribution of your work? What did you do and achieve? What makes it different from previous research?
3. Validity of the model. Does it really do what you say it does?
4. Results. What is new compared to previous results?
5. Implications and future work. What does this all mean? What are your conclusions and recommendations? What do you plan to do next?

This abstract only has a minimal amount of background information (two lines). This background information is given so that reader can understand the context of the author's research.

Context setting should never take up more than 25% of the whole abstract, as it probably contains information that the reader already knows. Your readers want new information, not old information. Remember that the reader may be a referee who has to read hundreds of abstracts to decide which to include for a conference or in a journal. He / She wants to know immediately what the topic is and will be negatively affected if forced to wait several lines before understanding this. Of course, you can (and should) give more background details in the Introduction.

12.5 Social and behavioral sciences. How should I structure my abstract? How much background information?

Here is an abstract from a fictitious paper entitled *Is it Time to Leave Him?* written by one of my PhD students, Estrella Garcia Gonzalez from Madrid. By *sitting-zapping sessions* she means sitting like a zombie in front of the television and constantly changing channels.

> (1) Three red flags were identified that indicate that the time to leave him has come. These red flags are: five burps per day, two sitting-zapping sessions per day, and fives games on the Playstation with friends per week. (2) A large number of women have doubts about the right moment for leaving their partner. Often women wait in hope for a change in their partner's habits. (3) One hundred couples were analyzed, recording their daily life for six months. Women were provided with a form to mark the moments of annoyance recorded during the day. Burps, sitting-zapping sessions and games on the Playstation with friends produced the highest index of annoyance. (4) The probability of eliminating these habits was found to be significantly low when the three red flags had been operative for more than three months. (5) Thus, these numbers provide a good indication of when the time to leave him has come. With these red flags, women will no longer have to waste their time waiting for the right moment.

Below is a series of instructions for writing an abstract based on Estrella's structure. Again, the numbers refer to the numbers in the abstract.

1. Begin the abstract with one or two sentences saying what you did plus one key result, i.e. begin with information that the reader does NOT already know
2. Introduce the background by connecting in some way to what you said in your introductory sentence. The concept of leaving him is introduced in (1) and then referred to again in (2)
3. Use the background information (which the reader may or not already know) to justify what you did, and outline your methodology (and materials where appropriate)
4. Provide some more information on your results
5. Tell the reader the implications of your results

12.6 I am a historian. We don't necessarily get 'results' or follow a specific methodology. What should I do?

If you analyze history abstracts, and other abstracts from humanistic disciplines, they still have a structure that is similar to a scientific abstract.

You have a primary objective (e.g. a theory or perspective that you would like to share, test, analyze or question), a design to your research, some methods and procedures that you used, some outcomes from your research that support your theory / perspective, and some conclusions or implications derived from these outcomes.

Abstracts from social and behavioral sciences tend to devote more space to background issues and context setting. The 'thesis' is often formulated as a series of questions that inform the reader about what issues will be dealt with in the paper.

In any case your abstract should include the following:

- background information
- your aim and its importance
- your contribution and its value
- what you looked at
- your conclusions and implications

Here is a fictitious abstract from a researcher interested in the history and evolution of languages.

> (1) The Quaker movement was founded in the mid 17th century by George Fox. One of the practices used by this rebellious religious group was the use of 'plain speech' and

'simplicity'. This involved addressing all people with the same second person pronoun, in the words of Fox: 'without any respect to rich or poor, great or small'. The modern use of 'you' in the English language (in the 10th century England there were 12 forms of 'you') is thus attributed to Fox's egalitarian movement. (2) Was this use of 'you' for addressing all kinds of people, regardless of their social status, specifically initiated by Fox? Or was it simply a part of an organic unplanned process in the English language of ridding itself of unnecessary devices and formalities? Are some languages more dynamic than others? And does this depend on how 'controlled' they are by official prescriptions? (3) By analyzing 50 English texts from 1012 to 2012, I show that English has successfully eliminated all accents on words, simplified punctuation use, virtually made the subjunctive redundant, and reduced the average sentence length by more than half from around 35 in the convoluted style of the 18th century to 14 words today. (4) Our findings show that English has the potential for being democratic, concise yet profound, and simple to understand. (5) I believe that this has implications for those languages, such as French, Italian, Korean and Turkish, that have conservative academies for safeguarding the 'purity' of their language.

The above abstract covers the following elements, which typically appear in humanistic abstracts. The numbers below refer to the numbers in the abstract.

1. Background information - there tends to be more context setting in humanistic than in scientific abstracts, and this may take up even 50% of the text
2. Gap in the knowledge - here the author challenges the accepted view on the topic. Using the question format, the author tells the reader what areas of the topic he plans to address. Questions create variety in an abstract and give it added interest
3. Methodology and results - the author provides some brief information on the data he used to get his findings
4. Conclusions
5. Implications - having implications in some way justifies why the author did his work, it gives the work relevance, it shows that the work makes a real contribution and was not just carried out for the author's own personal interest

12.7 I am writing a review. How should I structure my Abstract?

As with all abstracts of all disciplines, when you are writing a review you need to tell audience what your primary objective is. Given that you will not have space to review every paper in the literature, you should then explain your reasons for selecting certain papers. Your 'results' are your findings drawn from analyzing the literature. Finally, for your review to have a real purpose you will want to state your conclusions and what implications they have for further research in your field.

So once again your structure is: aim, methodology (selection process), results, conclusions, and implications.

12.8 How should I begin my Abstract?

When you read an advertisement for a product it never begins *The objective of this advertisement is to convince you to buy …* Instead advertisers go straight to the point. Abstracts are like advertisements for your paper.

You want your abstract to stand out so that there will be a better chance someone will notice it and read it. If you begin your abstract with commonly used phrases (by both native and non native English speakers) such as *This paper deals with … The aim of this paper … This article explores … We report …* you are not differentiating yourself from the others. In fact, some journals advise against using such expressions.

Below are some examples taken from abstracts in very different fields.

	ORIGINAL VERSIONS (OV)	REVISED VERSIONS (RV)
1	In this paper we present the design and development of a *highly innovative* software application //, Transpeach, which allows *mobile phone users* to use their own native language when speaking to someone of another native language. The prototype version enables a Japanese mobile phone user …	To extend automatic translation from written to oral communication we developed Transpeach. This software allows, for instance, a *Japanese mobile phone* user to talk to a Greek counterpart in Greek, likewise the Greek's words are automatically translated into Japanese.
2	We present a procedure for the analysis of the content of // organic materials present in archeological samples. The procedure allows the identification of a *wide variety* of materials within the same micro sample.	Archeological samples used for identifying organic materials are by necessity extremely small. We have found a way, which *we believe* is the first of its kind, to accurately identify *glycerolipids, natural waxes, proteinaceous, resinous and polysaccharide* materials within the same micro sample.
3	In this article we conduct an exploration of the crucial of role of the // invention of the steam engine in the Industrial Revolution, and specifically the modified version created by James Watt, the Scottish inventor born in 1736. However, *we contend that the merit* for the success of the steam engine should be …	James Watt's modified steam engine is widely acknowledged as paving the road to the Industrial Revolution. But was this Scottish inventor really the brains behind the steam engine? We *contend that Henry Wallwork*, a little-known Mancunian foundry entrepreneur, should be given more credit for …

In the OVs readers have to wait up to 15 words (i.e. until //) before reaching a key word that enables them to understand the potential relevance of the topic. They have to read words and expressions that they have read thousands of time before and which add absolutely no value to the abstract. In the RVs, the reader

learns either immediately or very quickly what the author has done to fill the knowledge gap.

RV1: In the first sentence the author manages to combine both the background (automatic written translation) with the new information (automatic oral translation). The words *highly innovative* have been removed. More concrete examples are given, which reflect what the prototype does.

RV2: The abstract now begins with *archeological samples*, so that the reader can immediately understand the general topic of the paper. The vague phrase *a wide variety of materials* has been replaced with concrete examples of these materials. This makes the RV slightly longer than the OV, but it now has a much stronger impact.

RV3: The abstract now gets straight to the point without the initial redundancy of the OV. The OV contains a detail - the birth date of James Watt - that serves no purpose for the reader and has thus been removed in the RV.

Going back to RV1, rather than telling your readers that what you have done is *highly innovative*, it might be more effective if you demonstrate the innovation element so clearly that readers reach this conclusion by themselves. This does not mean you always have to be modest about your achievements. In fact in RV2 the phrase *which we believe is the first of its kind* has been added to draw the reader's attention the contribution of the paper. The term *highly innovative* is subjective, *first of its kind* is informative.

12.9 What style should I use: personal or impersonal?

There are four possible styles for writing abstracts and papers:

STYLE 1	I found that x = y.
STYLE 2	We found that x = y.
STYLE 3	It was found that x = y.
STYLE 4	The authors found that x = y.

The style you use will depend on your discipline and on the requirements of the journal. Using the first person singular (Style 1), is generally only found in humanistic fields where the author's opinions are often outlined. Here is an example - an abstract from a paper (Sect. 10.2) entitled *International scientific English: Some thoughts on science, language and ownership.*

STYLE 1 The intention of this paper is to raise some questions about the 'ownership' of scientific English. Its author is a native speaker of English and a teacher of scientific English, but it aims its arguments at the international scientific community communicating in English. The paper is deliberately somewhat provocative in parts in an attempt to raise some questions about 'scientific English' which *I think* are important but which have not been faced to date.

Style 2 is found in all fields. Here is an example of the beginning of an abstract from a physics paper entitled *Tumbling toast, Murphy's Law and the fundamental constants*.

> STYLE 2 *We investigate* the dynamics of toast tumbling from a table to the floor. Popular opinion is that the final state is usually butter-side down, and constitutes prima facie evidence of Murphy's Law ('If it can go wrong, it will'). The orthodox view, in contrast, is that the phenomenon is essentially random, with a 50 / 50 split of possible outcomes. *We show* that toast does indeed have an inherent tendency to land butter-side down for a wide range of conditions.
>
> [to tumble = to fall and turn; butter-side down = people in Britain often put butter on one side of their toast]

Style 3 is also very common and many journals insist on this style. For an example of this style see the abstract in Sect. 12.5.

Style 4 is the least common style. Here is an example of the beginning of an abstract from a fascinating psychology paper entitled *Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments*

> STYLE 4 People tend to hold overly favorable views of their abilities in many social and intellectual domains. *The authors* suggest that this overestimation occurs, in part, because people who are unskilled in these domains suffer a dual burden: Not only do these people reach erroneous conclusions and make unfortunate choices, but their incompetence robs them of the metacognitive ability to realize it. Across 4 studies, the authors found that …

For links to these papers see page 311.

12.10 What tenses should I use?

The most commonly used tenses in abstracts are the PRESENT SIMPLE (*we show*) and the PAST SIMPLE (*we showed*).

The author of the "tumbling toast" abstract (Style 2) uses the PRESENT SIMPLE to:

- describe the contents of his paper (*we investigate, we show*).
- describe the common opinion that he is trying to question (*the phenomenon is essentially random*)
- refer to what he did during his experiments (*We show that toast does indeed have an inherent tendency*)
- give his conclusions - not shown here - (*Murphy's Law appears to be an ineluctable feature of our universe*)

In fact he uses only the PRESENT SIMPLE. Even though his research has already been done (thus the investigation is complete), he uses the PRESENT SIMPLE

because he wants to make his abstract sound more dynamic and his conclusions more convincing. However, in the paper itself he uses the PAST SIMPLE to describe what he did and found.

In the "incompetence" abstract (Style 4), the authors use the PRESENT SIMPLE to:

- talk about a well-known situation (*people tend to hold overly favorable views*)
- explain their opinion on this well-known situation (*the authors suggest that …*)

They then use the PAST SIMPLE to describe what they did / achieved and what conclusions they reached (*the authors found that* ..). This is the standard way to use tenses in abstracts.

The author of the "scientific English" abstract (Style 1) ends his abstract by using the PRESENT PERFECT (*which have not been faced to date*). You can use the PRESENT PERFECT and the PRESENT PERFECT CONTINUOUS when you describe a situation that began in the past and is still true now. This is typical when you are giving the context / background.

> In the last few years there *has been* considerable interest in …
>
> Since 2010 attention *has focused* on …
>
> To date, there *has not been* an adequate analytical model …
>
> For more than a decade data analysts *have been developing* new ways to …

Note: the underlined parts highlight the past-to-present timeframe. For example, *in the last few years* means a situation or action that began a few years ago and is still true today. *To date* means so far in the history of this particular branch of study.

Some authors also use the PRESENT PERFECT (in the active or passive) to describe what they achieved during their research.

> We *have found / devised / developed* a new approach to X. We *have demonstrated / proved / validated* the effectiveness of this approach by …
>
> A new approach to X *has been devised.* The effectiveness of the approach *has been demonstrated* …

12.11 How do I write a structured abstract?

Structured abstracts, which look like mini-papers, are becoming more and more popular. They are typically found in medicine, but also in economics, natural sciences and other areas. Most authors agree that the structured format helps them to write clearer abstracts. Structured abstracts also force the author to answer all the

questions (including limitations to their research) that referees and readers are likely to ask.

In addition, they are much more readable as referees (for their peer reviews) and readers can find exactly what they want quickly.

As with all abstracts, it is very important that you follow the journal's instructions to authors which will tell you what sections to include in your abstract and what style to adopt.

This sort of abstract tends to be longer (up to 400 words) and is often written as a series of points, though full sentences with verbs are always used in the Results and Conclusions.

Here are some typical sections in a structured abstract:

From a journal of vegetation sciences:

Question - Location - Methods - Results - Conclusions

From an economics journal:

Purpose - Design / Methodology / Approach - Findings - Practical implications - Originality / value - Keywords - Paper type

From various medical journals:

Background / Context / Purpose - Methods - Results / Findings - Conclusions

Context - Aim / Objective - Design - Setting - Patients (or Participants) - Interventions / Treatment - Main Outcome Measure(s) - Results - Conclusions

Context - Objective - Data Sources - Study Selection - Data Extraction - Results - Conclusions

Other sections sometimes found include: Level of evidence, Clinical relevance, Data collection / Extraction methods.

See page 314 (20.4) for a link to an example of a structured abstract that has important implications for non-native researchers.

12.12 How do I write an abstract for a conference?

An abstract for a journal has to be relevant to the specialization of that journal. Likewise, an abstract for a conference must *really* fit the conference theme. This point is absolutely essential. Occasionally in the rush to organize the conference the editorial board may initially accept your abstract on the basis that it sounds interesting. Then a few months later when you send them your full version, the editors may realize that it does not actually fit the theme. So if it doesn't fit, choose another conference.

Try to ensure that your abstract will not just be enticing for the editorial board but also that it will be suitable for publishing in the conference handbook / proceedings. Your title should be interesting but not too obscure or too colloquial / witty. It can be less 'technical' than a title for a journal, and many often contain two parts (Sect. 11.5) - the first part is technical, and the second part contains a more informal interpretation of the first part. Or vice versa - the first part is more fun, and the second more serious.

If the conference that you plan to go to is not in its first edition, you can look at abstracts from the previous editions to see their style and tone. In any case, the rules for writing the abstract itself are the same as for a journal, though your style may be slightly more informal.

12.13 How do I write an abstract for a work in progress that will be presented at a conference?

Conferences are generally planned up to two years in advance. When you answer the call for papers, your research may not yet be complete, but nevertheless you think that the conference would be a good way to get feedback on your progress. Below is the first draft of an abstract on how students choose the topic for their doctorate. It was written for a conference by Rossella Borri, an Italian PhD student in Political Sciences, whose research at the time of writing the abstract was only in its initial stages. Her initial draft, below, was not suitable for a conference - it is misleading because it is still a work in progress, which is not apparent from the draft.

> With its focus on the research cycle, scientific methodology has devoted a great deal of attention to the phase of problem solving. However, the issue of problem choice has been relatively neglected, notwithstanding its relevant epistemological implications. What are the criteria used by PhD students to set their research agenda? To what extent is the research agenda driven by pure curiosity about social phenomena? How much is it a matter of bargaining with various resource limitations? A survey was carried out among PhD students of European universities to examine the criteria used in the choice of their dissertation topics. The analysis sheds light on the way scientific knowledge is crafted, and about the challenges and limitations researchers face during this process.

The abstract would be fine if she had finished her research - which is what most readers would understand. The problem is that it gives no idea of the fact that the research is only at the beginning and that the data from the survey have as yet not been analyzed. It is thus rather misleading and those who go to her presentation at the conference might be very disappointed not to hear the concrete results that the abstract seems to promise. Having shown her abstract to her tutor who warned her of such a possible misinterpretation, Rossella then revised the second part of the abstract by saying:

> We are *currently* carrying out a survey of 500 PhD students of European universities to examine the criteria employed in the choice of their dissertation topics. Analysis of the data

> *will explore* the relationship between factors such as the duration of the PhD programme, the availability of a scholarship or background experience in the field and PhD students' criteria for choosing the specific issue that they wish to study. Initial results from the first 20 surveys *seem to indicate* the importance of the availability of funding and the potential job prospects rather than preferences driven by pure interest for its own sake. We *hope* to shed light on the way scientific knowledge is crafted and about challenges and limitations young researchers face during this process.

The abstract now contains the words *currently, will explore, seem to indicate*, and *we hope*, all of which highlight that this is ongoing research. By adding some of the initial results, the audience at the conference will be interested to know whether these results were confirmed when the whole battery of surveys was analyzed.

Your abstract should encourage conference attendees to come and hear you rather than going to a parallel session. If you don't have any results at all, you should either consider going to a later conference when you have something more conclusive to say, or tell readers what you expect your results to show.

12.14 How should I select my key words? How often should I repeat them?

There is a lot of mystery around how Google and other search engines use key words when indexing websites and articles. In any case it makes sense to have key words in your abstract (and title too) because it forces you, the author, to decide what words in your paper really are important. The key words are also the words that readers are looking for in their initial search and then when they actually scan your abstract. General consensus seems to be to not repeat the key words more than three times in the abstract. This can be tedious for the reader. More importantly, 'keyword spamming' may lead to the web page being rejected by the search engine.

Some journals require you to have a list of four or five key words directly under your abstract. The same journals may also require that the keywords in this list should not appear in the text of the abstract.

Make sure you have a very clear idea of the policy regarding key words of the journal or conference before submitting your abstract.

12.15 Should I mention any limitations in my research?

You should certainly mention the limitations of your research at some point in the paper. However, given that an Abstract is designed to 'sell' your research, you might decide not to mention the limitations until the Discussion (Sect. 17.11).

12.16 What should I not mention in my Abstract?

You should try to avoid:

- background information that is too generalist for your readers
- claims that are not supported in the paper
- terms that are too technical or too generic - this will depend on your audience
- definitions of key terms
- mathematical equations
- generic quantifications (e.g. *many, several, few, a wide variety*) and the overuse or unjustified use of subjective adjectives (e.g. *innovative, interesting, fundamental*).
- unnecessary details that would be better located in your Introduction, such as the name of your institute, place names that readers will not have heard of
- references to other papers. However, if your whole paper is based on an extending or refuting a finding given by one specific author, then you will need to mention this author's name.

12.17 How can I ensure that my Abstract has maximum impact?

There are three main ways to do this. Firstly, put the information in the best possible order. Secondly, highlight the importance of what you are saying. And thirdly, be as concise as possible. To see full examples of how to do this, see Sects. 4.6 (putting info in best order), 8.9 (highlighting), and 5.15 (being concise).

12.18 What are some of the typical characteristics of poor abstracts?

The following abstract, from a fictitious paper entitled *An innovative methodology for teaching English pronunciation,* has a series of problems.

> The English language is characterized by a high level of irregularity in spelling and pronunciation. A computer analysis of 17,000 English words showed that 84% were spelt in accordance with a regular pattern, and only 3% were completely unpredictable [Hanna et al., 1966]. An example of unpredictability can be found in English numbers, for example, *one, two* and *eight*. Interestingly, English spelling a thousand years ago was much more regular and almost phonetic. Words that today have a similar spelling but radically different pronunciation, such as *enough, though, cough, bough* and *thorough*, once had different spellings and much more phonetic pronunciations. In this paper, a pioneering method, developed by the English For Academics Institute in Pisa (Italy), of teaching non-native speakers how to quickly learn English pronunciation is presented and discussed.

The problems are:

- it is not self sufficient. If readers read this abstract in isolation from the paper, they would have no idea about what the author actually did in his / her research, nor what was found
- it looks like the beginning of an Introduction not an Abstract. Apart from the last line it is all background information. This information is interesting and relevant to the topic of the paper. But it is not new information. Basically, it tells the reader nothing about what contribution the author has made to this field of study
- it contains a reference to another authors work, Hanna. This is not common in an Abstract
- it mentions irrelevant details. In an abstract the reader does not really need to know where the research was carried out, particularly in this case where the exact location of the research (Pisa, Italy) is totally irrelevant - it has no impact on the findings
- the pioneering method is not described, nor do we have any idea about why it is 'pioneering'
- the reader has no idea of what results were obtained

The result is that readers in this field - English pronunciation - are likely to skip this article and move on to the next one they find. A better version of the abstract would be:

> We have developed a didactic method for addressing the high level of irregularity in spelling and pronunciation. We combine new words, or words that non-native speakers regularly have difficult in pronouncing, with words that they are familiar with. For example, most adult learns have few problems in pronouncing *go, two, off* and *stuff* but may have difficulties with *though, cough* and *rough*. Through associations - *go / though, two / through, off / cough, stuff / tough* - learners can understand that familiar and unfamiliar words may have a similar pronunciation and can thus practice pronouncing them without the aid of a teacher. Tests were conducted on 2041 adults selected at random from higher education institutes in 22 countries and incorporating five different language families. The results revealed that as many as 85% of subjects managed to unlearn their erroneous pronunciation, with only 5% making no progress at all. We believe our findings could have a profound impact on the way English pronunciation is taught around the world.

The revised version is better because:

- readers are immediately told what the author did. There is no background information because the context is well known
- the methodology is explained and a concrete example is given
- the selection process of the subjects (*adults*) is described
- the results are given
- numbers are qualified (*as many as* 85%, *only* 5%) to help readers understand whether the numbers reflect normal expectations, or are particularly high or low
- the implications are stated
- the word 'pioneering' is avoided - it is left to the reader to decide if the method is pioneering or not

The result is that readers in this field are more likely to be stimulated into reading the rest of the article.

12.19 Summary: How can I assess the quality of my Abstract?

To make a self-assessment of your Abstract, you can ask yourself the following questions.

- Have I followed the journal's instructions to authors? Have I followed the right structure (i.e. structured, unstructured) and style (*we* vs passive)?
- Have I covered the relevant points from those below?
  - background / context
  - research problem / aim - the gap I plan to fill
  - methods
  - results
  - implications and/or conclusions
- Have I chosen my keywords carefully so that readers can locate my Abstract?
- Whenever I have given my readers information, will it be 100% clear to them why they are being given this information? (You know why, but they don't.)
- Can I make my Abstract less redundant? If I tried to reduce it by 25% would I really lose any key content?
- Have I used tenses correctly? PRESENT SIMPLE (established knowledge), PRESENT PERFECT (past to present background information), PAST SIMPLE (my contribution)

Chapter 13
Introduction

What key skills are needed when writing an Introduction?

The Introduction presents the background knowledge that readers need so that they can appreciate how the findings of the paper are an advance on current knowledge in the field. A key skill is to be able to say the same things that have been said many times before but in a different, interesting, intriguing way.

You have to give the reader the tools for understanding the meaning and motivation of your experiments.

Tell your readers how you plan to develop your topic. Give them a roadmap to follow - show them what your line of argument is.

You need to have a deep knowledge about everything that has been previously written on the topic and decide what is important for the reader to know.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_13, © Springer Science+Business Media, LLC 2011

Typical complaints of referees

The Introduction occupies too high a proportion of the entire paper and contains too many general statements that are already widely known. The rationale and objectives are not defined and the whole section is completely disorganized - it is not clear what problem the author is addressing or trying to solve and why they chose their particular methodology. Much of the initial part is essentially a cut and paste from the Abstract.

The author has not related the background information to the objective of the paper. Also, there is no mention of what the reader can expect in the rest of the paper (i.e. main results and conclusions) and how this information will be structured (i.e. into the various sections).

Please remember that the paper may be read by inexperienced Ph.D. students or others starting their work in your specific field. Hence, please add an explanation or at least a reference when mentioning notions related to … and the terminology for ...

13.1 How should I structure the Introduction?

An Introduction generally answers the following questions. You can use the answers to these questions to structure your Introduction.

- What is the problem?
- Are there any existing solutions (i.e. in the literature)?
- Which solution is the best?
- What is its main limitation? (i.e. What gap am I hoping to fill?)
- What do I hope to achieve?
- Have I achieved what I set out to do?

13.2 How should I begin my Introduction?

Below and in Sect. 13.3 is an example of the structure of a typical Introduction. It consists of a sequence of ten parts, each with a specific role. Your Introduction will not necessarily include all ten parts nor sequence them in the same order.

Your aim is to include only enough background information to allow your reader to understand why you are asking the questions you are, in what context they appear, and why your hypotheses, predictions or expected results are reasonable. It is like a preview to the rest of the paper. Thus nearly every Introduction, irrespectively of the discipline, would incorporate those parts marked with an asterisk (*).

The proportion of space given to each part (particularly with regard to the review of the literature) will obviously vary from discipline to discipline, and from paper to paper.

You could begin with one or more of the first four parts listed below.

	FUNCTION	AUTHOR'S TEXT
1	definition of the topic plus background	An XYZ battery is a battery that ... The electrodes in an XYZ telephone battery are made of a composite of gold and silver, coated with a layer of platinum. The gold and silver provide structural support, while the platinum provides resilience.
2	accepted state of the art plus problem to be resolved	The performance of the battery can be strongly affected by the number of times the battery is recharged and the duration of each individual recharge. The battery is subject to three possible failure modes. ...
3	authors' objectives	A research program has recently been started by the authors in collaboration with a major battery manufacturer, with the goal of developing new design models for XYZ batteries. Analytical techniques are needed that can predict ...
4	introduction to the literature	Computational techniques have been extensively applied to the study of the lifetime of XYZ batteries, in particular with regard to the number of times a battery is charged. However, little research to date has focused on the length of each individual recharge.

Below is an analysis of Parts 1–4 of the Introduction. In brackets is a very approximate indication of how many sentences you will probably need for each part.

PART 1 DEFINITION OF THE TOPIC PLUS BACKGROUND (1–3)

This introductory phrase may not be necessary in your paper. Here the definition of the XYZ battery indicates to the reader that this is the background topic (i.e. the general context) of the paper. This is the place to include notations, technical definitions, and explanations of key words.

The second sentence gives information that readers should already be familiar with and suggests why the topic is important and of interest. It will help readers to understand why you are investigating this area and how you hope to extend the knowledge. It sets the context for the information that will follow in (3), which may be less familiar for your readers. Readers want to quickly learn what the specific topic of your research is, they are much less interested in being reminded how important the general area of research is.

PART 2 ACCEPTED STATE OF THE ART PLUS PROBLEM TO BE RESOLVED (2–4)*

In the example text, XYZ batteries is the general context. The authors now move from this general context to the specific area of their research: XYZ batteries in telephones, and more specifically, the problems inherent in such batteries. This is the gap that the authors want to fill and that the readers should be most interested in. This part should state in simple and clear language exactly what the problem is, why you chose it, why you claim it is important.

PART 3 AUTHORS' OBJECTIVES (1–2)*

Here the authors outline their major objectives, i.e. how they intend to fill the gap. Parts 6 and 7 (see next page) could be incorporated here. This part also serves as a transition into the review of the literature.

PART 4 INTRODUCTION TO THE LITERATURE

This introduces the background literature that the authors intend to refer to in order to motivate their particular research. It makes a reference to current insufficient knowledge of the topic.

This may be in a separate section with its own heading (Review of the Literature – see Chap. 14), or after the Results in a clinical paper, or incorporated into the Discussion.

13.3 How should I structure the rest of the Introduction?

The Introduction outlined the previous subsection continues as follows:

	FUNCTION	AUTHOR'S TEXT
5	survey of pertinent literature	More recent research has occurred in the field of laptop and jPud batteries. Evans [15] studied the lifetime in 5G jPud batteries. Smith [16] and Jones [18] found that ... However their findings failed to account for ...
6	authors' contribution	To the best of our knowledge there are no results in the literature regarding how the length of each recharge impacts on the silver and gold in the electrodes.
7	aim of the present work	The aim of the present work is to construct a model to perform a comprehensive investigation of the effect of recharging on the electrodes, and to find a new proportion in the amount of metals used. The assumptions of Smith [16] and Jones [18] are used as a starting point. ...
8	main results / conclusions	The results of the model are encouraging and show that ...
9	future implications	This new model will be able to ...
10	outline of structure	Section 2 introduces the concept of ...

Below is an analysis of Parts 5–10.

PART 5 SURVEY OF PERTINENT LITERATURE

This part reviews the literature in the author's precise field. As in the previous part, it often draws attention to problems that have still not been solved. For example, you may think a particular study did not investigate some necessary aspect of the area, or how the authors failed to notice some problem with their results.

You only need to describe what is necessary for the specific purposes of your paper. Much of this literature will then be used for comparative purposes in the Discussion.

The length of the literature review (i.e. Parts 4 and 5) ranges from a paragraph to several pages. See Chap. 14 for details on how to write it.

PART 6 AUTHORS' CONTRIBUTION (1–2)*

Here the authors make a very clear statement of how what they describe in the paper represents an advance on current knowledge (i.e. the knowledge outlined in parts 2, 4 and 5).

PART 7 AIM OF THE PRESENT WORK (1–2)*

This statement of the goal to be reached is essential in any Introduction. It should be in a separate paragraph and expressed so that the referee (and readers) are 100% clear about the objectives of your research and the expected outcome. You will need to tell readers what method you used and possibly why you chose this method.

PART 8 MAIN RESULTS OF THE PRESENT WORK (1–4)

Although your main results will be given in other sections of your paper (typically in your Abstract, Results, Discussion and Conclusions), many authors also announce them here to show how the background situation plus their contribution have led to particular results.

PART 9 FUTURE IMPLICATIONS OF THE WORK (1–2)

Some authors prefer to delay mentioning implications to the Discussion or even to the Conclusions. However, mentioning implications here gives readers an instant idea of the possible importance of your work, which may be useful for them as they read the rest of the paper.

PART 10 OUTLINE OF STRUCTURE (3–4 VERY SHORT SENTENCES)

This may not be necessary if the structure of your paper is completely standard for your chosen journal, and thus readers will already know in what order the various elements of your research will be presented. See Sect. 13.8 on how to write the structure.

13.4 I do not work in the field of a 'hard' science. Are there any other ways of beginning an Introduction?

Clearly, not all disciplines would use the structure outlined in Sects. 13.2 and 13.3, though they would still cover some of the same main points. An alternative, and quite common approach, is to set the context and research goal in a series of questions.

Here is an example from a dissertation entitled *The Effects of Feedback and Attribution Style on Task Persistence* by psychology student Chris Rozek. Persistence means the ability to adhere to a task, to persevere with something rather than giving up.

> Persistence is an attribute valued by many. What makes some people persist longer than others? Are internal factors, such as personality traits, or external situational factors, such as feedback, responsible for persistence? Could the answer include a combination of both? These are the questions this experiment attempted to answer.

The general topic is mentioned in the very first word (*persistence*) of a very short sentence (seven words). This enables the reader to immediately focus on and understand the context (corresponding to point 2 in the structure of an Introduction given in Sect. 13.2). Within this context, the second sentence, in the form of a question, outlines the issue that Chris plans to address in his paper (point 3). His next sentence poses the typical attributes associated with persistence (similarly to point 5). The question *Could the answer include a combination of both?* hints at what the likely findings are of his paper (point 7). The final sentence highlights that Chris will cover all the aspects he has mentioned so far. His Introduction then continues with a literature review (point 6) and concludes with his final hypothesis (similarly to point 9).

Chris has neatly covered a lot of points typically mentioned in an Introduction. He has achieved this in very few sentences and with a format (questions) that immediately involves the reader by encouraging them to formulate their own answers and thus to continue reading.

13.5 What typical phrases should I avoid in my Introduction?

Referees have to read a lot of papers. While this can be a very rewarding task, it can also be quite tedious when many Abstracts and Introductions seem to begin in the same way. Thus, some writing experts advise avoiding stock phrases (i.e. typical phrases that everyone uses) at the beginning of the introduction. For example: *Recent advances in ... The last few years have seen ...* Instead they recommended beginning in a more direct way.

13.6 How does an Introduction differ from an Abstract?

There is some overlap between an Abstract and the Introduction. However, a frequent problem is that authors may cut and paste from their Abstract into their Introduction, which can be very repetitive for readers.

Below are the first two sentences from the Abstract and Introduction from a paper (or 'Letter' as it is called in the journal where this study appeared) entitled *Fragmentation of Rods by Cascading Cracks: Why Spaghetti Does Not Break in Half* by Basile Audoly and Sébastien Neukirch. These sentences highlight the distinct ways that an Abstract and Introduction should be written.

> ABSTRACT When thin brittle rods such as dry spaghetti pasta are bent beyond their limit curvature, they often break into more than two pieces, typically three or four. With the aim of understanding these multiple breakings, we study the dynamics of a bent rod that is suddenly released at one end.

INTRODUCTION The physical process of fragmentation is relevant to several areas of science and technology. Because different physical phenomena are at work during the fragmentation of a solid body, it has mainly been studied from a statistical viewpoint [1–5].

The Abstract immediately tells the readers the specific topic of the paper and then what the author's goal is (corresponding to Points 2, 3 and 7 in the structure of an Introduction given in Sects. 13.2 and 13.3). Instead, the Introduction sets the context in very general terms (Point 2).

The abstract then continues as follows.

ABSTRACT We find that the sudden relaxation of the curvature at this end leads to a burst of flexural waves, whose dynamics are described by a self-similar solution with no adjustable parameters. These flexural waves locally increase the curvature in the rod, and we argue that this counterintuitive mechanism is responsible for the fragmentation of brittle rods under bending.

As you can see, the Abstract gives no further background information, but highlights what the authors found in their research. An absolute minimum number of words have been used. This gives the Abstract substantial impact by telling readers only what they need to know to enable them to decide whether to read the whole paper. As is standard for Abstracts, no references to the literature are made.

On the other hand about 50% of the rest of the Introduction is dedicated to helping the readers see that the general trend given in the first two sentences is being countered by another line of research. In this case, references to the literature are made. Readers are alerted to the alternative trend by the link word *nevertheless*.

INTRODUCTION Nevertheless a growing number of works have included physical considerations: surface energy contributions [6], nucleation and growth properties of the fracture process [7], elastic buckling [8, 9], and stress wave propagation [10]. Usually, in dynamic fragmentation, the abrupt application of fracturing forces (e.g. by an impact) triggers numerous elementary breaking processes, making a statistical study of the fragments sizes possible. This is opposed to quasi-static fragmentation where a solid is crushed or broken at small applied velocities [11].

The concluding sentence of the Abstract is:

ABSTRACT A simple experiment supporting the claim is presented.

This eight-word sentence is expanded considerably in the Introduction, by describing more about what the experiment consisted in, and the result it gave. Note: the text reported below is the rest of the Introduction in its entirety.

INTRODUCTION Here we consider such a quasi-static experiment whereby a dry spaghetti is bent beyond its limit curvature. This experiment is famous as, most of the time, the pasta does not break in half but typically in three to ten pieces. In this Letter, we explain this multiple failure process and point out a general mechanism of cascading failure in rods: a breaking event induces strong flexural waves which trigger other breakings, leading to an avalanche like process.

I suggest you use a similar comparison between Abstracts and Introductions taken from your chosen journal, to see:

- what parts from Sects. 13.2 and 13.3 are covered in the Introduction. In the spaghetti paper, Parts 1–8 are condensed into eight sentences, Parts 9 and 10 are not mentioned
- how they are structured differently
- what elements from the Abstract the Introduction expands on
- how sentences from the Abstract are paraphrased in the Introduction
- what information is covered in the Abstract but not in the Introduction, and vice versa
- the relative word counts. This will give you an idea of the proportionate length of the Introduction compared to the Abstract. In the spaghetti paper the Abstract is 116 words, and the Introduction 201 words, so the Introduction is approximately twice as long. This is quite typical

13.7 What tenses should I use?

In this section, the example sentences S1, S3 and S5 are taken from Audoly and Neukirch's paper (Sect. 13.6), and S2, S4 and S6 from Rozek's paper (Sects. 13.4 and 14.2).

The PRESENT SIMPLE is generally used to begin the Introduction in order to describe the general background context, i.e. what is known already.

S1. The physical process of fragmentation *is* relevant to several areas of science and technology.

S2. Persistence *is* an attribute valued by many.

The PRESENT PERFECT is then used to show how the problem has been approached from the past until the present day.

S3. Because different physical phenomena are at work during the fragmentation of a solid body, it *has mainly been studied* from a statistical viewpoint [1–5].

S4. Persistence *has most often been studied* in terms of cultural differences.

During the review of the literature several tenses are used (Sect. 14.4).

At the end of the Introduction, the PRESENT SIMPLE is used again when the authors state what they will do in the rest of their paper (*we explain, I hypothesize*).

S5. In this Letter, we *explain* this multiple failure process and *point out* a general mechanism of cascading failure in rods: a breaking event induces strong flexural waves which trigger other breakings, leading to an avalanche like process.

S6. Because of these findings, I *hypothesize* that subjects with internal attribution styles (as measured by the APCSS), higher levels of perfectionism, and any form of feedback *will show* greater task persistence.

In S5 Audoly and Neukirch use the PRESENT SIMPLE to report their findings (see the underlined verbs). Not all authors use the PRESENT SIMPLE in this context because

a general convention (but not rule) is that when you present your findings you use the PAST SIMPLE - the idea is to use the PRESENT SIMPLE for what is already accepted in the literature, and the PAST SIMPLE for your new contribution (Sect. 16.7).

In S6 Rozek uses the FUTURE SIMPLE to talk about his claim / conclusion. This usage of the future tends to be confined to where authors set out to prove a hypothesis, rather than to give hard results.

13.8 How should I outline the structure of my paper?

Check with your journal's instructions to authors with regard to whether an outline of the structure is required. If it is, or if you notice that all the papers in the journal have one, then your aim should be to describe this structure as concisely as possible (as in the RV).

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The paper is structured as follows: in Section 2 a survey of the works related to X is provided. In Section 3 the method that we propose for the analysis of X is shown. In Section 4 the tool that automatizes this methodology is presented and in Section 5 its components are described. In Section 6 the experience in the application of the tool to industrial case studies is reported and discussed and finally, in Section 7, conclusions are provided and future works described.	Section 2 *surveys* the works related to X. Section 3 *outlines* our method for analyzing X. In Section 4 the tool that automatizes this methodology is presented, and in Section 5 its components are described. Section 6 *discusses some industrial case studies* using the tool.

The RV is approximately half the length of the OV, 45 words rather than 84. This is achieved by:

- deleting unnecessary sentences. Some journals and reviewers advise that there is no need to have an initial sentence saying *The paper is structured as follows.* Simply beginning a new paragraph at the end of the Introduction is enough to alert the reader that you are now going to talk about the structure
- using active verbs (*surveys*) rather than only passive (*a survey ... is provided*). For the sake of variety, the RV also includes some passive forms. But you could, if you wish, use active forms throughout and thus would further reduce the length of the paragraph
- removing other redundancy. For example, the phrase *the experience in the application of the tool to industrial case studies is reported and discussed* is unnecessarily verbose

13.9 Summary: How can I assess the quality of my Introduction?

To make a self-assessment of your Introduction, you can ask yourself the following questions.

- ➢ Is my research question clear?
- ➢ Does my Introduction act as a clear road map for understanding my paper?
- ➢ Is it sufficiently different from the Abstract, without any cut and pastes? (some overlap is fine)
- ➢ Have I mentioned only what my readers specifically need to know and what I will subsequently refer to in the Discussion?
- ➢ Have I been as concise as possible?
- ➢ Have I used tenses correctly? PRESENT SIMPLE (general background context, description of what will be done in the paper), PRESENT PERFECT (past to present solutions), PAST SIMPLE (my contribution, though this may also be expressed using the PRESENT SIMPLE or FUTURE SIMPLE)

Chapter 14
Review of the Literature

What key skills are needed when writing a Review of the Literature?

The key skill is to provide readers with just the right amount of literature regarding the sequence of events leading up to the current situation - not too much to make it tedious, nor too little so that the context of your research is not meaningful to them. The background information is useful because it allows you to:

- Systematically elaborate the achievements and limitations of other studies
- Relate your new facts and data to these studies

The amount of detail you need to give varies immensely from discipline to discipline. In some disciplines you may be required to have a very strong theoretical framework for your study, thus requiring two or more pages.

In other disciplines just one paragraph may be enough. So another skill is to take into account readers who are up to date with your research area and thus not to delay giving the new information for too long.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_14,

Typical complaints of referees

The author has not made it clear why some references are mentioned. They appear to be there just to make the paper longer (in which they succeed perfectly) and seem more important (in which they fail), rather than as support for the author's approach.

The authors do not seem to be aware of the state of the art, I strongly recommend they widen their literature search. In addition, they have too many references from work carried out in their own country - the literature review is not international enough and the context is thus too myopic.

There are papers cited in the bibliography that are not mentioned in the paper, and vice versa. These should be removed or added as appropriate.

14.1 How should I structure my Review of the Literature?

A Literature Review generally answers the following questions, and generally in the following order. You can use the answers to these questions to structure your Literature Review.

1. What are the seminal works on my topic? Do I need to mention these?
2. What progress has been made since these seminal works?
3. What are the most relevant recent works? What is the best order to mention these works?
4. What are the achievements and limitations of these recent works?
5. What gap do these limitations reveal?
6. How does my work intend to fill this gap?

14.2 How should I begin my literature review? How can I structure it to show the progress through the years?

Below is an extract from the Introduction to a paper entitled *The Effects of Feedback and Attribution Style on Task Persistence* where psychology student Chris Rozek begins his review of the literature (see Sect. 13.4 for how he begins the Introduction).

> Persistence has most often been studied in terms of cultural differences. Blinco (1992) found that Japanese elementary school children showed greater task persistence than their American counterparts. School type and gender were not factors in moderating task persistence. This left culture as the remaining variable.
>
> Heine et al. (2001) furthered this idea by testing older American and Japanese subjects on responses after success or failure on task persistence. Japanese subjects were once again found to persist longer (in post-failure conditions), and this was speculated to be because they were more likely to view themselves as the cause of the problem. If they were the cause of the problem, they could also solve the problem themselves; although, this could only be accomplished through work and persistence. Americans were more likely to believe that outside factors were the cause of failure.
>
> These cultural studies hinted that task persistence may be predictable based on attribution style. A later experiment showed that attribution style and perfectionism level can be correlated with final grades in college-level classes (Blankstein & Winkworth, 2004).

The first sentence of the first paragraph introduces the main topic (cultural differences), and the rest of the paragraph briefly reviews a major study on this topic. The implications of this study (culture as the remaining variable) are summarized at the end of the paragraph.

The first sentence of the second paragraph then moves on to the next (in chronological terms) major study. Chris summarizes Heine's work in a way that involves the reader: he uses the verb *speculated* and then continues the next sentence using *if* which gives an example of this speculation.

The first sentence of the third paragraph summarizes the findings of the first two paragraphs in order to introduce some more recent findings.

Note also his use of tenses. In his first sentence, which is a very general overview, he uses the PRESENT PERFECT. Then when he talks about the work of specific authors and makes a summary of each step in the chronology of the literature he uses the PAST SIMPLE.

Chris's structure is thus:

1. introduction to topic
2. support from the literature
3. mini summary
4. introduction to next topic. And so on.

This technique works very well because it tells a story - it is a logical build up to the reason behind Chris's investigation that readers can easily follow. In fact, the final sentence to his Introduction begins: *Because of these findings, I hypothesize that …* Chris has gradually prepared his readers for the focus of his work: his own personal hypothesis regarding persistence.

You can find another (longer) example of a literature review that adopts similar strategies in Sect. 10.2.

14.3 What is the clearest way to refer to other authors? Should I focus on the authors or their ideas?

There are various styles for making reference to other authors. The four styles below contain the same information, but the focus is different.

STYLE 1 *Blinco [1992] found* that Japanese elementary school children showed …
STYLE 2 *In [5] Blinco found* that Japanese elementary school children showed …
STYLE 3 A *study* of the level of persistence in school children *is presented by Blinco* [1992].
STYLE 4 A greater level of persistence has been noticed in Japan [5].

In Style 1, the author, Blinco, is given as much importance as what he (i.e. Blinco) found. You might choose this style for one of three reasons: (i) it is simply the easiest style to use and the most readable for authors, (ii) you may want to focus on the

author more than what he/she found, (iii) you may want to compare two authors (e.g. *While Blinco says X, Heine says Y*).

Style 2 is similar to Style 1, but in this case perhaps you are talking about more than one paper by Blinco, so in this case the paper is the most logical first element in the sentence.

In Style 3, what Blinco found is more important than the fact that Blinco found it. This is a very typical style, but inevitably involves using the passive, which then leads to longer and heavier sentences.

In Style 4 Blinco is not mentioned at all, but only a reference his paper in parentheses.

The style you use will depend on your journal's "Style Rules", but is likely to contain an element of flexibility. In fact, Chris Rozek's Introduction in Sect. 14.2 he uses two styles:

> Heine et al. (2001) furthered this idea by testing …
>
> … can be correlated with final grades in college-level classes (Blankstein & Winkworth, 2004)

He does this to:

- Change the focus from author to findings
- Create variety for the reader

14.4 What tenses should I use?

The PRESENT SIMPLE (S1) or PRESENT PERFECT (S2) are generally used to introduce the literature review.

S1. In the literature there *are* several examples of new strategies to perform these tests, which all *entail* setting new parameters [Peters 1997, Grace 2004, Gatto 2005].

S2. Many different approaches *have been proposed* to solve this issue.

Use the PRESENT PERFECT again to refer to ongoing situations, i.e. when authors are still investigating a particular field. Even though specific past dates are mentioned in S3 and S4 below, these dates are part of a series of dates that describe situations that researchers are still working on today and will continue in the future.

This means that PAST SIMPLE cannot be used in any of these three cases.

S3. Since 1998 there *have been* many attempts to establish an index [Mithran 1999, Smithson 2002], but until now no one *has managed* to solve the issue of ….

S4. As yet, a solution to Y *has not been found*, although three attempts *have been made*. [Peters 1997, Grace 2004, Gatto 2007].

S5. So far researchers *have* only *found* innovative ways to solve X, but not Y [5, 6, 10].

In S3–S5 note the underlined words. These are adverbials of time that are typically used with the PRESENT PERFECT because they indicate something that began in the past (i.e. when research first began in this area) and continues into the present. They represent unfinished situations.

You must use the PAST SIMPLE when:

- The year of publication is stated within the main sentence (i.e. not just in brackets)
- You mention specific pieces of research (e.g. you talk about initial approaches and methods that have subsequently probably been abandoned)
- You state the exact date when something was written, proved etc.

In S6–S8 below we are talking about completely finished actions, so the PRESENT PERFECT cannot be used.

S6. The first approaches *used* a manual registration of cardiac images, using anatomical markers *defined* by an expert operator along all images in the temporal sequence. Then in 1987, a new method *was introduced* which …

S7. This problem was first analyzed in 1994 [Peters].

S8. Various solutions were found in the late 1990s [Bernstein 1997, Schmidt 1998].

In all other cases, the simplest solution is to follow the style of the examples below.

S9. Lindley [10] *investigated* the use of the genitive in French and English and his results *agree* with other authors' findings in this area [12, 13, 18]. He *proved* that …

S10. Smith and Jones [11, 12] *developed* a new system of comparison. In their system two languages *are / were compared* from the point of view of … They *found* that ….

S11. Evans [5] *studied* the differences between Italian and English. He *provides / provided* an index of .. He *highlighted* that …

In S9–S11 the first verb introduces the author and is typically used in the PAST SIMPLE. Other similar verbs are, for example: *examine, analyze, verify, propose, design*, *suggest, outline*.

Note that the first verb in S9–S11 could also be in the PRESENT SIMPLE. However, generally when the PRESENT SIMPLE is used the construction is slightly different (S12): first the reference and then the author.

S12. In [5] Evans studies the differences ….

In any case, even in S12 the SIMPLE PAST (*studied*) would be fine.

The second verb in S9–S11 describes what the authors found. In S9 *agree* is logical because Lindley's findings still agree today with the findings in the papers referenced at the end of the sentence. In S10 and S11, both PAST SIMPLE and PRESENT SIMPLE are possible. However, it is common to use the PRESENT SIMPLE when describing how a system, method, procedure etc. functions. In S10 the PRESENT

SIMPLE underlines that Smith and Jones are still using their system and that it is still valid. The use of the PAST SIMPLE (*were compared*) in S10 would probably imply that Smith and Jones' system is not in use anymore and it was just a step in this road of research that has subsequently been superseded.

The third verb in S9–S11 indicates what the author managed to do (*find, obtain, prove, demonstrate, highlight*), and typically such verbs are used in the PAST SIMPLE (*found, obtained* etc.*).* Again, however, some authors use the PRESENT SIMPLE in such cases.

Use the PRESENT SIMPLE to discuss previously published laws, theorems, definitions, proofs, lemmas etc. Such published work is generally considered to be established knowledge and the use of the PRESENT SIMPLE reflects this.

S13. The theorem *states* that the highest degree of separation is achieved when …

S14. The lemma *asserts* that, for any given strategy of Player 1, there is a corresponding …

14.5 How can I reduce the amount I write when reporting the literature?

Redundancy is often high in the review of the literature, as highlighted in the OVs below.

	ORIGINAL VERSION (OV)	REVISED VERSION (RV)
1	Long sentences *are known to be* characteristic of poor readability [Ref].	Long sentences *are* a characteristic of poor readability [Ref].
2	*In the literature* the use of long sentences *has also been reported* in languages other than English [Ref].	Long sentences *are* not exclusive to English [Ref].
3	The use of long sentences *has been ascertained* in various regions of Europe during the Roman period [Ref].	Long sentences *were used* during the Roman period in various regions of Europe [Ref].
4	The concept of author-centeredness *has been suggested as playing* a role in the construction of long sentences [Ref].	Author-centeredness *may play* a role in the construction of long sentences [Ref].
5	*Several authors have proposed* that in scientific writing the occurrence of a high abundance of long sentences *is* correlated to … [Ref].	In scientific writing the occurrence of a high abundance of long sentences *may* be correlated to … [Ref].

The OVs are not bad English, and if you use them occasionally they are absolutely fine. However, if you always refer to the literature in this way you will create a series of unnecessarily long sentences with considerable redundancy. This makes it hard for the reader to immediately identify the key points of the literature.

Nearly all the words in italics in the OVs could be removed. This is because the reader knows from the reference (*[Ref]*) at the end of the sentence that you are discussing another author's work or one of your previous papers. See Chap. 7 on how to make a clear distinction between your current work, your previous work and the work of others.

However, if you do remove the words in italics, you still have to indicate whether something is known to be true (OVs 1–3), or is simply a suggestion or a proposal (OVs 4–5). For things that are known to be true today (RVs 1–2) you can use the PRESENT SIMPLE, and for things that are known to be true regarding the past (RV 3) you can use the PAST SIMPLE. To indicate that something has been suggested or proposed, you can use *may* (RVs 4–5). Because you have put the reference, your use of *may* indicates a general feeling in the community and not exclusively your feeling.

14.6 How can I talk about the limitations of previous work and the novelty of my work in a constructive and diplomatic way?

Sometimes in the Literature Review you want your readers to note the strong features of your work and the limitations of previous works by other authors. If what you propose has never been done before, you can begin your sentence as indicated by the words in italics below.

As far as we know, there are no studies on …

To [the best of] our knowledge, the literature has not discussed …

We believe that this is the first time that principal agent theory has been applied to …

If you want to mention the limitations of previous works you could adapt one or more of the following sentences:

Generally speaking patients' perceptions are *seldom* considered.

Results often appear to *conflict* with each other …

So far X *has never been applied* to Y.

Moreover, no attention has been paid to …

These studies have *only* dealt with the situation in X, *whereas* our study focuses on the situation in Y.

To learn more about how to highlight your contribution and discuss the limitations of others see Chaps. 8 and 9, respectively.

14.7 Summary: How can I assess the quality of my Literature Review?

To make a self-assessment of your Literature Review, you can ask yourself the following questions.

- Have I mentioned only what my readers specifically need to know and what I will subsequently refer to in the Discussion?
- Are the papers I have mentioned in a logical order? Is it clear why I have chosen these papers and not others?
- Have I selected a disproportionate number of papers from my own country?
- Have I followed my journal's instructions regarding how I make references to the literature? Where possible have I done this in a variety of ways?
- Have I removed any redundancy when reporting the literature?
- Have I used tenses correctly? PRESENT SIMPLE (descriptions of established scientific fact), PRESENT PERFECT (at the beginning of review to give general overview; for past-to-present evolutions), PAST SIMPLE (when specific dates are mentioned within a sentence; for the verbs that introduce an author's findings)

Chapter 15
Methods

What key skills are needed when writing the Methods?

This section has several different names including: 'Methods', 'Methods and Materials', 'Experimental', 'Method Description and Validation'. In this chapter, I will always refer to it as Methods.

In most journals the Methods section follows the Literature Review, in others it follows the Conclusions.

The secret of writing this section is to be able to describe the materials you used in your experiments and/or the methods you used to carry out your research, in a way that is sufficiently detailed to enable others in your field to easily follow your method and, if desired, even replicate your work. A key skill is to make sure the descriptions are complete and yet are also as concise as possible, for example by referring to other works in the literature, including your own, that make use of the same or similar methods.

Another key skill is to write extremely clearly, with generally not more than two steps described in one sentence, and in a logical order. This will then enable your readers to easily follow your description.

Researchers generally agree that the Methods the easiest section to write because your methods are likely to be clear in your mind, so it may be a good point for you to begin writing your manuscript.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_15,

Typical complaints of referees

The methods are not adequately described and are incomplete. How many samples were collected at each sampling? Which sampling method was used and why? Which fraction was analyzed?

No data treatment is shown (statistics, replicates, etc.). Statistical analysis must be reported.

Some of the procedures used were in no way obvious. The authors should justify their rationale for choosing such procedures. At other times the authors repeated a lot of well known published data, when they could have simply used a reference.

15.1 How should I structure the Methods?

The Methods section should answer most of the following questions, obviously depending on your discipline:

- What / Who did I study? What hypotheses was I testing?
- Where did I carry out this study and what characteristics did this location have?
- How did I design my experiment / sampling and what assumptions did I make?
- What variable was I measuring and why?
- How did I handle / house / treat my materials / subjects? What kind of care / precautions were taken?
- What equipment did I use (plus modifications) and where did this equipment come from (vendor source)?
- What protocol did I use for collecting my data?
- How did I analyze the data? Statistical procedures? Mathematical equations? Software?
- What probability did I use to decide significance?
- What references to the literature could I give to save me having to describe something in detail?
- What difficulties did I encounter?
- How does my methodology compare with previously reported methods, and what significant advances does it make?

You should provide enough quantitative information (concentration, temperature, weight, size, length, time, duration etc.) so that other researchers can replicate what you did. Describe everything in a logical order to enable readers to easily follow what you did. This will usually be chronological (but see Sect. 15.9), i.e. the order in which you conducted the phases of your tests. It may also help the reader if you use subheadings to explain the various stages of the procedure, which you can then use again (perhaps with modifications) in the Results.

Your experiments, sampling procedures, selection criteria etc. may have more than one step. It helps your readers if your description of each step follows the same logical order.

Ensure that you cover every step required. Because you are very familiar with your method, you may leave out key information either thinking that it is implicit (and thus not worth mentioning) or simply because you forget.

15.2 How should I begin the Methods?

How you begin will very much depend on your discipline. To help you decide, take a look at the Methods section in papers from your chosen journal, and see how authors start this section.

Typical ways include:

(a) making a general statement about your method

The method described here is simple, rapid, sensitive and ...

(b) referring to another paper

The materials used for isolation and culture *are described* elsewhere [20].

Materials *were obtained* in accordance with Burgess et al.'s method [55].

(c) stating where you obtained your materials from

Bacterial strains ... *were isolated* and kindly supplied by ...

Agorose for gel electrophoresis *was purchased* from Brogdon plc (Altrincham, UK).

(d) explaining how you found your subjects, i.e. begin with the setting

Subjects *were chosen* from a randomly selected sample of ...

Participants *were selected* from patients at the Gynecology Faculty of the University of ...

(e) indicating where (i.e. a geographical region) your investigation was focused

Our empirical investigation focused on Tuscany, a central region of Italy, ...

The study *was carried out* in four boulevards in Athens (Greece) and ...

(f) referring the reader to a figure which shows the experimental set up

To highlight the advantages of the system, Fig. 1 shows the ...

(g) starting directly with the first step in your procedure

Frontal cerebral cortices *were dissected* from ...

Core-cell composite materials *were prepared* by colloidal assembly of ...

15.3 What tense should I use? Should I use the active or passive?

Most Methods sections are written in the PAST SIMPLE using the passive form. Examples of this usage are highlighted in italics in the examples in Sect. 15.2.

The PAST SIMPLE is required because the actions you describe took place in the past (i.e. before you started to write your paper). The PAST SIMPLE also helps to

distinguish what you did from what others have done (which is often described in the PRESENT SIMPLE).

The passive is good style here because the focus is on what was done rather than who did it. Thus you can ignore any expert advice that tells you that the passive should always be avoided. It should be avoided, but only where it is not necessary. In the Methods the passive is both necessary and appropriate.

Greg Anderson, who is the genius behind the biology website at Bates College in Maine, USA, writes the following about the style you should adopt in the Methods section. What he writes clearly not only applies to the field of biology.

> The style in this section should read as if you were verbally describing the conduct of the experiment. You may use the active voice to a certain extent, although this section requires more use of third person, passive constructions than others. Avoid use of the first person in this section. Remember to use the past tense throughout - the work being reported is done, and was performed in the past, not the future. The Methods section *is not* a step-by-step, directive, protocol as you might see in your lab manual.

15.4 How many actions can I refer to in a single sentence?

A frequent problem in the Methods is that the description reads like a manual, where each individual detail or action is described in a single sentence. Given that you are describing a procedure rather than making a complex analysis, it is perfectly acceptable to have two actions in one sentence.

Below is the first paragraph from a medical paper in which the author describes how she selected the participants for her survey on depression. The word 'practice' means an association of medical doctors who offer a service to the public. The 'list size' is the number of patients the practice has.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
A first postal invitation to participate in the survey was sent to 26 practices in South Yorkshire. A total of five practices indicated their willingness to participate. Multidisciplinary focus groups in four diverse practices were purposively identified. The identification entailed using a maximum variation approach. This approach was based on socio-economic population characteristics and ethnic diversity. These characteristics were taken with reference to census data.	Following a first postal invitation to participate sent to 26 practices in South Yorkshire, five responded positively. Multidisciplinary focus groups in four diverse practices were purposively identified using a maximum variation approach, based on socio-economic population characteristics and ethnic diversity (by reference to census data).

The OV is in correct English and is perfectly acceptable provided that this style is not used continuously throughout the Methods. If it is used continuously, the reader will soon find it tedious, particularly as each sentence begins in the same way (i.e. with a noun).

The technique of the RV is simply to combine two steps into a single sentence, with no extra effort on the reader's part in terms of understanding.

On the other hand, you do not want to have too much information in the same sentence. In the OV below, the reader would find the information much more difficult to assimilate than in the RV, even though the information given is exactly the same.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The four practices, which had been previously identified as having list sizes between 4750 and 8200, comprised firstly an inner city practice (hereafter Type 1) with an ethnically diverse population for which the team frequently required translators for primary care consultations, secondly, two urban practices with average levels of socio-economic deprivation (Type 2), and thirdly, a mixed urban/rural practice (Type 3).	The four practices had a list size ranging between 4750 and 8200. They comprised: • an inner city practice with an ethnically diverse population, where the team frequently required translators for primary care consultations • two urban practices with average levels of socio-economic deprivation • a mixed urban /rural practice

In the first three lines of the OV, two pieces of information are included, where the additional information is placed between commas (in italics below):

> The four practices, *which had previously been identified as having list sizes between 4750 and 8200*, comprised firstly an ...

This kind of construction should not be used too often as it separates the subject (*practices*) from the verb (*comprised*) – see Sect. 4.9. Readability is generally increased when the subject and verb are close together, as in the RV. The next lines of the OV then continue with a list of three items. It is much easier if these items are put into three different sentences.

15.5 How can I avoid my Methods appearing like a series of lists?

It is important to be concise in the Methods. But conciseness does not mean writing a series of lists (as in S1). This style may be appropriate on a presentation slide, but should be avoided in a paper. What you write should always sound natural if read aloud. S1 does not sound natural.

S1. Processes which often occur in lipids include: oxidation, hydration, dehydration, decarboxylation, esterification, aromatisation, hydrolysis, hydrogenation and polymerization. Factors that affect the chemistry of these materials include: heat (anthropogenic transformations), humidity, pH, and microbial attacks.

S2 still contains the same *processes* and *factors* as S1, but the way these are introduced sounds more natural - even though it requires more words.

S2. Several processes often occur in lipids, including oxidation, hydration, dehydration, decarboxylation, esterification, aromatisation, hydrolysis, hydrogenation, and polymerization. In addition, the chemistry of these materials can be affected, for example, by heat (anthropogenic transformations), humidity, pH, and microbial attacks.

15.6 Can I use bullets?

The second RV in Sect. 15.4 uses bullets to list the three types of practices. This makes it easier to read and also provides variety in the layout. However, refer to your journal's style guide to check whether bullets are permissible.

You only need to number your bullets if each bullet describes a step that is part of a chronological sequence.

15.7 How can I reduce the word count?

The style of the first RV in Sect. 15.4 is to present more than one action per sentence. This reduces the number of words that are required - the RV is more than 20% shorter than the OV.

Other ways to reduce the word count are:

- assume your readers have basic knowledge of the techniques used in your field, you can thus delete any superfluous information
- cite a reference rather than detailing the procedure again if any of your methods are fully described elsewhere (in one of your papers or someone else's)
- use tables and figures to summarize information
- be concise - see Chap. 5

15.8 How should I designate my study parameters in a way that my readers do not have to constantly refer backwards?

In the second OV in Sect. 15.4 the author has designated the three types of medical practices as Type 1, Type 2 and Type 3. This enables her to save time whenever she has to refer to one of the practices. It saves her time, but not the reader. Later

in the Methods (or even in the Results or Discussion), whenever readers see, for example, Type 1 they will have to refer backwards to remember which practice Type 1 refers to.

Although I generally recommend being concise, in this case conciseness is annoying for readers. It is much easier for readers to read *inner city practice* than *Type 1*.

Another timesaver for the author is to use an invented acronym. So in this case, the author could have written *ICP* for *inner city practice*. But the same problem arises: the reader is forced to remember what *ICP* refers to.

15.9 Should I describe everything in chronological order?

The basic idea is present everything in your experiments, trials, procedures etc. in a way that will make best sense to your reader. The fact you did something before or after something else, may not be relevant for your reader, so in such cases chronology is not important.

However within a sentence or paragraph, readers should feel they are moving forward chronologically.

S1. *The sample, which was filtered and acidified at pH 2, was mixed with X.

S2. *The sample was filtered and acidified at pH 2 and then mixed with X.

S3. The sample was filtered and acidified at pH 2, and then mixed with X.

S4. The sample was filtered and acidified at pH 2. It was then mixed with X, which enabled the resulting solution to stabilize at ...

In S1 the main idea is that the sample was mixed with X, but we seem to be going backwards (to the filtering and acidification) before we go forwards again to the mixing. S2 resolves this problem by removing the *which*-clause and presenting the steps in sequence. However, S2 uses *and* twice, which means the reader may be initially confused with regard to which two items are connected with each other (*filtered* + *acidified*, or *acidified* + *mixed*). This is resolved in S3 by the addition of a comma after *pH 2*. However the clearest version is S4, which simply begins a new sentence.

S1 is an example of a very short sentence that could be rewritten more clearly. Often such sentences are much longer, so the technique given in S4 (rather than S3) is often the best solution.

15.10 What grammatical constructions can I use to justify my aims and choices?

You often need to be able to explain why you made certain choices in the light of what they subsequently enabled you to do.

To introduce your choices you can use the following constructions:

> *In order to validate* the results, we first had to ...
>
> *In an attempt to identify* the components, it was decided to ...
>
> *To provide a way of characterizing* the samples, an adaptation of Smith's method [2011] was used.
>
> *For the purpose of investigating* the patients previous medical history, we ...
>
> *Our aim was to get* a general picture of ...
>
> *This choice was aimed at getting* a general picture of ...

The examples highlight that there are many ways (not all mentioned here) to express your aims and intentions. The important thing is to choose the right verb form (see the underlined verbs in the examples): the infinitive (*to test*) or the *-ing* form (*of testing, at testing*).

However, all the examples could be expressed much more simply using the infinitive form alone (e.g. *To validate the results. To identify the components. To characterize the samples*).

Another way to talk about your choices is to use the verb *to choose*. But note the construction:

> This equipment was *chosen for* its low cost.
>
> This equipment was *chosen (in order) to* save money.

15.11 What grammatical construction is used with *allow, enable* and *permit*?

There are several verbs in English that mean 'give the capability of' and highlight for your readers what your initial choices subsequently helped you to achieve.

Allow and *enable* are the most commonly used in research papers, and outside computer science they can generally be used interchangeably. Another verb is *to permit*, which is used less frequently as it often has the meaning of an authority

giving someone the permission to do something. All three verbs require the same specific construction. In the examples below I have just used *allow*, but in all these examples from a grammatical point of view *allow* could be replaced with *enable* and *permit*.

GRAMMATICAL CONSTRUCTION	EXAMPLE
allow someone or something to do something	This equipment allowed us to identify X.
allow someone or something to be + past participle	This equipment allowed X to be identified.
allow + noun	This equipment allowed the identification of X.

All three examples mean exactly the same thing. The first is the shortest and most commonly used. It is also the one that gives rise to the most mistakes. This is because *allow, enable* and *permit* require an agent before the infinitive. Hence the use of *us* in the first example is obligatory.

Allow, enable and *permit* involve long constructions but can often be eliminated, generally without any change in meaning. If you find yourself using *allow* and *enable* very frequently, then consider using the alternatives given below. In some cases you may feel that the RV is slightly different in terms of meaning from the OV, in such cases it is best to stick with the OV.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Limiting the Xs *allows* the complexity of Y *to be reduced* and permits *the user to control* the deduction process.	Limiting the Xs *reduces* the complexity of Y, and *facilitates control* of the deduction process.
The analysis *allowed the characterization of pine resin* as the main organic constituents in the sample to be achieved.	The analysis *showed that pine resin* was the main organic constituent in the sample.
This model *permits the analysis* of X.	This model *can analyze* X.
	With this model *we can analyze* X.
	With this model, X can be determined
The use of these substrates *enabled us to highlight* the presence of several nucleases.	The use of these substrates:
	highlighted the presence of ...
	meant that we were able to highlight the presence of ...
	offered a means *to highlight* the presence of ...

Note that in the RVs, the verb *let*, which means the same as *allow, enable* and *permit*, has not been used because in most journals it is considered too informal.

15.12 How can I indicate the consequences of my choices and actions?

In Sect. 15.10 we saw how (i) to indicate the rationale behind your choices, then in 15.11 (ii) what this choice enabled you to do. Now we will look at how to describe the consequences of (i) + (ii). Here are some examples:

S1. An evaluation of this initial data demonstrated that X = Y,
thus giving an insight into the function of Z.
thereby providing a basis for investigating the function of Z.

S2. An evaluation of this initial data demonstrated that X = Y.
Consequently the next step was to investigate the function of Z.
The next step was *thus / therefore / consequently* to investigate ...

The examples above give two alternative endings.

In S1 the sentence is in two parts divided by a comma after *Y*. Note how *thus* and *thereby* require the *-ing* form after them. The *-ing* form alone, without *thus* and *thereby* could be ambiguous (Sect. 6.5).

In S2 the first sentence ends with Y. The first word in the next sentence is *consequently*. It would be possible to put *thus* and *therefore* (but not *thereby*) at the beginning of the sentence too but their most natural position is after the verb *to be* (Sect. 2.12). Other alternative words are *hence*, which is most generally used in mathematics, and *so*, which is generally considered too informal for research papers.

15.13 How should I use the definite and indefinite articles in the Methods?

Below is the first part of the entire experimental section of a paper entitled *Growth of Diamond Films from Tequila* by Mexican researchers Javier Morales et al. Their English reflects the typical use of English in scientific papers, by native and non-native authors, but which EFL and EAP trainers may find strange.

> Small pieces of *a Si* (100) wafer and commercial stainless steel (type 304) were used as substrates, fixed to the holder through silver paste. *Temperature* was controlled at 850°C through *an automatic* PID temperature control (Eurotherm). *Reactor pressure* varied from 4.76 to 4.99 Torr due to the injection processes and to the flash evaporation phenomena. The carrier and reaction gases flux were fixed at 0.8 and 0.1 l/min, respectively. "Tequila blanco" (white tequila) Orendain brand, a clear, un-aged liquor distilled from the juice of blue agave (Agave Tequilana) plant [9], was used *as precursor*.

In italics I have highlighted some issues with articles (*a/an, the*). In the first line *Si* stands for silicon. If you read the sentence you would probably read it as: *a silicon wafer* and not *an Si wafer*. *Si* is not an acronym - you would say, for example, *an SOS*, because each letter in SOS stands for a separate word. In SOS the S is pronounced ESS and therefore requires *an* (see Sect. 11.15) because of the initial vowel sound (as in *an automatic* in the third line).

In Morales' paper, like in most scientific papers, the use of *a* and *the* goes against the normal rule of a singular countable noun requiring a preceding article (see Sects. 6.6 and 11.14). Morales uses, like many native speakers, *temperature* and *reactor pressure* without a preceding *the*. However, other authors opt to use *the* in exactly the same situation. Clearly in such contexts both forms are permissible.

Likewise, Morales writes *as precursor*, which in general English would have to be *as a precursor*, which is what some other authors in the literature use. So again, in these cases at least, both forms seem to be possible, though the solution with *a* is twice as common.

15.14 Should I write numbers as digits (e.g. 5, 7) or as words (e.g. five, seven)?

Below is the second and final part of Morales' experimental, which highlights some useful points with regard to numbers.

> This tequila, 80 proof and with C-H-O atomic relationships of 0.37 C, 0.84 H and 0.29 O (Figure 1), was injected at a frequency of 2 pulses per second (500 ms) with an opening time of 4 ms. A total of 21768 pulses were applied in each experiment and a micro dose of 6.26×10^{-3} ml was injected per pulse (Table 1). Temperatures in the evaporation zone and along the vapor transport line were fixed at 280°C. The deposit was studied through a Dilor micro-Raman spectrometer with a 20 mW, 632 nm He-Ne laser equipped with a confocal microscope and a JEOL Low-Vacuum Scanning Electron Microscope (JSM-6060LV), operating at 15 kV, secondary electrons, spot 50 and WD 11 mm.

The use of numbers varies from journal to journal and paper to paper. In Morales' paper all the numbers are written as digits rather than words (e.g. *2 pulses* rather than *two pulses*).

Other journals recommend using words for numbers from one to ten, and then digits. However this rule does not apply when the number precedes an abbreviation for a measurement (e.g. *9 mm*, not *nine millimeters*).

Note also that abbreviations for measurements do not have an *s* when they are plural (e.g. *9 mm*, not *9 mms*).

Another rule of style prohibits beginning a sentence with a number in digits. For this reason Morales correctly writes

... opening time of 4 ms. A total of 21768 pulses were applied ...

rather than

... opening time of 4 ms. 21768 pulses were applied ...

In fact, you can see clearly from these two examples why the rule exists. It exists to help readers see the numbers more clearly. Alternatively, you can begin a sentence with a written number:

Twenty thousand pulses were applied …

Clearly, if you begin a sentence with a number in words, the number has to be a short number. Writing the following would be ridiculous:

Twenty one thousand seven hundred and sixty eight pulses were applied …

The last sentence of Morales' experimental contains nine pieces of information, but it is not difficult to follow, and it would be strange to break the sentence down into smaller parts.

15.15 How can I avoid ambiguity?

Morales' experimental (see Sects. 15.4 and 15.13) is easy to read and follow. One reason for this is that it contains no ambiguity. There is no phrase that forces the reader to stop and interpret the meaning.

Unfortunately, not all Methods are written in this way.

In Robert Day's informative and very amusing book *How to Write and Publish a Scientific Paper*, several real examples of ambiguous sentences from Methods sections are given. Here are two of them:

S1. *Employing a straight platinum wire rabbit, sheep and human blood agar plates were inoculated ...

S2. *Having completed the study, the bacteria were of no further interest.

In S1 it seems that the rabbits were made of platinum wire, and in S2 it seems that the bacteria were responsible for completing the study. You may think that the real interpretations are very obvious, but the fact that Robert Day mentions them means that some referees and readers will also find them amusing and/or aggravating. One solution is to improve the punctuation as in S3, where a comma has been added after *wire*.

S3. Employing a straight platinum wire, rabbit, sheep and human blood agar plates were inoculated with ...

In S3 a comma has been added after *wire*. But the sentence is still not immediately clear because the use of a series of commas initially makes it seem like a list of things that were employed. S4–S6 are much clearer.

S4. Rabbit, sheep and human blood agar plates were inoculated with … by employing a straight platinum wire.

S5. Employing a straight platinum wire, we inoculated rabbit, sheep and human blood agar plates with …

S6. Rabbit, sheep and human blood agar plates were inoculated with ... This was carried out using a straight platinum wire.

S2 could be rewritten as:

S7. Once the study had been completed, the bacteria were of no further interest.

For more on such problems of ambiguity, see Chap. 6.

15.16 What other points should I include in the Methods? How should I end the Methods?

Not all Methods sections are as short as the one by Morales et al. (Sects. 15.13 and 15.14).

In some papers the methods are the main contribution of the paper. In such cases, subsections with subheadings (e.g. *sampling procedure, experimental set up, testing the model*) may help readers to understand the various stages or various components.

Your first subsection may be a general overview of the methods chosen, how they relate to the literature and why you chose them.

Then in each subsequent subsection you:

1. preview the part of the procedure / method you are talking about
2. detail what was done and justify your choices
3. point out any precautions taken (this also helps you gain credibility as a researcher who carries out his / her work accurately and thoroughly)
4. discuss any limitations in your method or problems you encountered
5. highlight the benefits of your methods (perhaps in comparison to other authors' approaches)

If your Methods section is short and does not require any subsections, then you could end it with one or more of points 3–5 above. If it is long, then you could end with some conclusions regarding the limitations and benefits (points 4 and 5) of your overall methodology.

However, many authors follow Morales' approach - essential, concise and no conclusions. As usual, the best solution is to analyze the Methods section in various papers that have been published in your chosen journal.

15.17 Summary: How can I assess the quality of my Methods section?

To make a self-assessment of your Methods section, you can ask yourself the following questions.

- Have I really described my Methods in a way that is easy for readers to follow and which would enable them to replicate my work? Have I ensured that I have covered every step? Is my structure clear and complete?
- Have I been as concise as possible? Have I used references to previous works rather than repeating descriptions that readers could easily find elsewhere?
- Do the individual sentences in each paragraph contain too many, too few, or just the right manageable number of steps? Have I ensured that my sentences don't sound like lists?
- Have I thought about the way readers prefer to receive information? (no ambiguity, no back referencing, everything in chronological order, headings, bullets)?
- Have I checked my grammar (infinitive, gerund, *allow, thus* etc.) with regard to how I outline how and why I made certain choices?
- Have I checked my journal's guidelines on how to use numbers?
- Have I used tenses correctly? PAST SIMPLE (in the passive form to describe what I did), PRESENT SIMPLE (descriptions of established scientific fact)

Chapter 16
Results

What key skills are needed when writing the Results?

Not all journals require a separate Results section, often it is integrated with the Discussion, under the section title Results and Discussion.

If you have a separate Results section then the standard procedure is to present them with little or no interpretation or discussion. This means that the Results is generally the shortest section in a paper.

The key skill is first to decide what results are representative, and then to organize them in a sequence that highlights the answers to the aims, hypotheses or questions that you set yourself at the beginning of the paper. In many disciplines this involves the use of figures and tables, which are commented on in the text. In other disciplines, findings are only reported in text form.

You should also mention any important negative results here.

From an English point of view the key skill is in reporting your results simply and clearly. If the referees of your paper cannot understand your results, then your contribution to the current knowledge base will be lost.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_16,

Typical complaints of referees

At times this paper reads like a thesis. The authors seem to have included all their results, with the consequence that I am not sure which findings are significant and which are not. However, I also suspect that some contradictory findings have not been included. So although I generally recommend brevity, this should not include leaving out key findings that do not support the authors' line of logic.

The Results section is too long and much of it is then repeated in detail in the Discussion. Moreover, most of the empirical results are rather obvious. That X = Y is hardly surprising. I cannot see any new or important aspects of this study.

Rather than highlighting the results that are significant or relevant, the authors have merely repeated in the text everything that they have put in their figures and tables, which in themselves seem to include every piece of data that the authors have elaborated in the last three years. This makes for very tedious reading. Moreover, I felt that I was not given the tools to understand for myself the significance of their data.

16.1 How should I structure the Results?

The Results should answer the following questions.

1. What did I find?
2. What did I not find?
3. What did I find that I was not expecting to find? (e.g. that contradicts my hypotheses)

A typical structure is to follow the order you used for the protocols or procedures in your Methods. You then use figures and tables to sequence the answers to the above questions.

16.2 How should I begin the Results?

There are two typical ways to begin the Results. The first is to give a general panorama of your surveys, experiments etc. without repeating the details you gave in the Methods section, as in the three examples below:

Overall, the results presented below show that …

The three key results of this empirical study are: …

The following emergent themes were identified from the analysis: …

The most common way is to simply go directly to your results, often by inviting readers to look at one of your figures or tables, either in the first sentence or very shortly after:

Figure 1 shows the mass spectra obtained from an analysis of the two residues. The first residue reveals a .. (Fig. 1a)

A total of 34 wheat genotypes (Table 1) were screened for … Responses to increased sunlight varied significantly (Figure 1) …

An analysis was made to look for … To do this, the average times of x and y were compared … Figures 1–3 show the differences between …

16.3 How should I structure the rest of the Results? How should I end the Results?

Before you begin writing, arrange your figures (tables etc.) in the most logical order for your readers, and which supports your initial aim or hypothesis that you stated in your Introduction. Then associate key findings with each of your figures, excluding any results that are not relevant in supporting your research hypothesis.

Note that 'not relevant' does not include results that contradict your hypothesis (Sect. 16.4).

The rest of the section then consists in commenting on these figures one by one. Maeve O'Connor in her book *Writing Successfully in Science*, recommends the following structure.

1. Highlight those results (including those from controls) that answer your research question
2. Outline secondary results
3. Give supporting information
4. Mention any results that contradict your hypothesis and explain why they are anomalous

16.4 Should I report any negative results?

Yes!

Dr Ben Goldacre, a campaigner against the suppression of negative data in medical papers, says:

> When you get a negative result, it feels as if it's all been a bit of a waste of time. It's easy to convince yourself that you found nothing, when in fact you discovered a very useful piece of information: the thing that you were testing doesn't work.

Of course, you may have got negative results for other reasons:

- your hypothesis was incorrect and needs to be reformulated
- you had a bad experimental design and / or low statistical power

As Dr. Donald Dearborn, of Bates College, comments:

> Your results may be of importance to others even though they did not support your hypothesis. Do not fall into the trap of thinking that results contrary to what you expected are necessarily "bad data". If you carried out the work well, they are simply your results and need interpretation. Many important discoveries can be traced to "bad data".

Negative data are frequently commented on in the Discussion (Sects. 17.12 and 17.13).

16.5 What tenses should I use when reporting my Results?

Your results are things that you found before you started writing the paper. They therefore relate to past events, consequently the PAST SIMPLE is used to report them, often in a mixture of the active and passive forms.

Below are some results from a medical paper. The author, medical doctor Caroline Mitchell, interviewed GPs (i.e. doctors) and nurses in the British National Health Service (NHS) to discover practices (in this case what is known as a *care model*) relating to depression. The indented parts in inverted commas are quotations of what the doctors and nurses said (I have only reported the beginnings of the quotations).

> The care model, *was seen* as a credible and holistic approach to the management of depression. GPs were keen to avoid 'over-medicalising' and over-prescribing of antidepressants:
>
> > "The big difference to the way we manage is having the mental health worker here more often, because …"
>
> However, there was a perceived failure of the NHS to provide adequate services to support adherence to the guideline. One GP *commented*:
>
> > "It's interesting when you look at the sort of treatments that …"
>
> GPs and mental health workers *described* very limited access to specialist input for patients with more complex, treatment-resistant or recurrent depression. One incident *was described* by a GP:
>
> > "I tried recently with a gentleman who has been on antidepressants for four or five years, …"

Dr Mitchell uses the PAST SIMPLE throughout but switches between the active and passive forms. When the topic is the most important element she uses the passive (*the care model was seen, one incident was described*). When it makes more sense to use a human subject, she uses the active (*one GP commented. workers described*).

16.6 What style should I use when reporting my Results?

When describing her results (Sect. 16.5), Dr Mitchell uses an impersonal style. This serves to add an element of objectivity to her findings. For instance, she does not say

S1. We found that doctors viewed the NHS as having failed to provide adequate services.

Instead she says:

S2. There was a perceived failure of the NHS to provide adequate services.

However, both S1 and S2 are accepted styles.

Note how the quotations in Dr Mitchell's text act like the figures and tables of other types of paper, by providing evidence for what is expressed in the sentences that precede them.

Here is an extract from another paper (Sect. 13.4), which again uses an impersonal style.

> Three levels of feedback *were looked* at for differences on task persistence. Differences between positive, negative, and no feedback conditions, were minimal and showed no significant findings … There were larger differences both between genders and in the interaction between gender and feedback conditions. Tables 1 and 2 *show* the averages for these gender differences. Figure 6 *shows* …

Note how the author uses the passive (*were looked at*) rather than the active (*I / we looked at*). This usage may either reflect the author's wish to remain in the background and let his results speak for themselves, and / or because he is following his journal's requirements. However, he uses the active when referring to figures and tables (*Figure 6 shows*).

16.7 Can I use a more personal style?

Here are some extracts from a Results section in a paper by economist, Andrea Mangani, regarding differences in content between online and print newspapers in Italy. The extracts highlight a much more personal style of reporting results:

> Collecting the data was quite difficult … On the other hand, the statistical analysis is rather simple. Table 2 shows … Notice that the difference between online and print variety increases during the daytime; this means that the diversity in online content tends to decrease from 09.30 to 17.30. We wondered whether the smaller degree of online variety depended on …

This kind of writing is less formal and helps the reader to become more involved in the research process. Andrea tells readers of his difficulties in collecting the data, but the ease of which he managed to analyze these data. He draws his readers' attention to the significance of his data (*Notice that* …). His readers are also involved in his thought and decision processes (*we wondered whether*). The result is a paper that reads a little a like a story, and is much more enjoyable to follow and therefore easier to digest.

Two more things to note:

- Andrea uses the PRESENT SIMPLE when interpreting his data (*online content tends to decrease*). This is very common when referring to data that clearly indicate a certain trend.
- Although Andrea was the sole author of the paper and conducted the research entirely by himself, he refers to himself as *we*. This is quite common in some journals where the use of the first person singular (*I*) is considered too informal.

Andrea's reader-friendly style may also be appropriate in the Discussion section.

16.8 How can I show my readers the value of my data, rather than just telling them?

Professor of ecology Ken Lertzman of the Simon Fraser University, gives the following advice in an excellent document available for download (page 313).

> Rather than telling the reader that a result is interesting or significant, show them how it is interesting or significant … show the reader what they need to know to come to their own conclusion about the result.

Ken gives two examples to highlight the difference:

S1. *The large difference in mean size between population C and population D is particularly *interesting*.

S2. While the mean size generally varies among populations by only a few cm, the mean size in populations C and D *differed by 25 cm*. Two hypotheses could account for this, …

In S1, the adjective *interesting* means something very definite for the author, but not for the reader who has not been given the tools to assess why the *mean size* is *interesting*. Such descriptive adjectives (*interesting, intriguing, remarkable*) are rarely helpful (see Sect. 9.4 for the dangers of such adjectives).

You need to give your readers sufficient information for them to be able to say to themselves: "wow that is interesting!" This is what S2 does by highlighting specific details (*differed by 25 cm*).

Adverbs such as *interestingly, intriguingly, remarkably* also suffer from the same problem. However, they can be used effectively if used at the beginning of a sentence, in order to attract attention to a key finding. So S2 becomes S3:

S3. *Interestingly*, while the mean size generally varies among populations by only a few cm, the mean size in populations C and D *differed by 25 cm*. Two hypotheses could account for this, …

However this technique should be used only once or twice in the whole paper, otherwise it loses its effect.

16.9 How should I comment on my tables and figures?

Dr Lertzman has similar ideas about 'showing not telling' with regard to figures and tables:

> When writing Results sections you should use the tables and figures to illustrate points in the text, rather than making them the subject of your text.

Following his advice, S1 should be rewritten as S2.

S1. *Figure 4 shows the relationship between the numbers of species A and species B.

S2. The abundances of species A and B were inversely related (Figure 4).

In S1 the author is merely telling readers what they can already see in the figure. S2 is much more helpful, because it focuses on the meaning that can be inferred from the figure. S1 forces readers to make their own interpretations (which may in fact be interpretations that you don't want them to make). S2 saves readers from making any mental effort and at the same time guides them towards the interpretation that you want them to have.

The OVs in the table below highlight some examples related to commenting on figures and tables.

	ORIGINAL VERSION (OV)	REVISED VERSION (RV)
1	As can be seen in Figure 1, levels of intolerance were highest during late adolescence.	Levels of intolerance were highest during late adolescence (Figure 1).
2	We can see from Table 2 that in the control group, values for early adolescence (13–15) were 6.5. On the other hand, values for mid adolescence (16–17) were 6.7.	Values for early adolescence were lower than for mid adolescence: 6.5 versus 6.7 (Table 2).
3	Figure 1 shows that levels of intolerance are 9, 15 and 20 during early, mid and late adolescence, respectively.	Levels of intolerance are highest during late adolescence (Figure 1).

Lack of conciseness is a frequent problem when describing data in figures and tables (Sect. 5.13). Avoid phrases such *as can be seen* (OV1) and *we can see* (OV2). Simply put the figure or table reference in brackets at the end of the sentence. OV2 also repeats information that should already be contained in the table, i.e. the respective age ranges for the three stages of adolescence.

To learn how to make concise references to figures and tables see Sect. 5.13.

RV2 combines the two sentences from OV2. Rather than just repeating the data in the table (as in OV2), RV2 interprets the data by comparing the results.

RV3 highlights that you do not need to reiterate each value from a figure or table. You just need to point out the key result or trend that the figure or table conveys.

Another typical mistake is to repeat word for word the caption / legend to your figures and tables within the main text. Legends should be as short as possible and be sufficiently detailed to enable your readers to understand the figure or table without having to read your text. It is vital that you pay attention to legends as some readers may only look at your figures and tables, without even reading the paper itself!

16.10 What is the difference between reporting and interpreting?

If you have a separate Results section, then the experts recommend that you should not make any interpretations of your data. Deciding what constitutes reporting and what constitutes interpreting is not straightforward. RV2 and RV3 in Sect. 16.9

interpret the data only in the sense that they highlight the importance of the data for the readers but without adding any subjective comments.

This is not the case in S2 below, which along with S1 is taken from the biology website at Bates College in Maine, USA (see link on page 312 (15.3)).

S1. The duration of exposure to running water had a pronounced effect on cumulative seed germination percentages (Fig. 2). Seeds exposed to the 2-day treatment had the highest cumulative germination (84%), 1.25 times that of the 12-h or 5-day groups and four times that of controls.

S2. The results of the germination experiment (Fig. 2) suggest that the optimal time for running-water treatment is 2 days. This group showed the highest cumulative germination (84%), with longer (5 d) or shorter (12 h) exposures producing smaller gains in germination when compared to the control group.

In S1 the authors highlight the trend / difference that they want the reader to focus on, no subjective interpretation is given. On the other hand, in S2 the reference to optimality is a conceptual model to which the observed result is then tied.

This differentiation between objective reporting and subjective interpretation is not an easy skill to acquire. If you are worried that your Results section may contain elements of subjectivity that are not appropriate (in terms of your field of study, or the requirements of your journal), then you should consider showing it to someone with considerable experience in writing who can certainly be someone of the same nationality as this is not essentially a language issue.

However, if your Results and Discussion are combined into one section, then S2 would be perfectly acceptable.

16.11 How can I make it clear that I am talking about my findings and not the findings of others?

None of the RVs in Sect. 16.9 make reference to the author, e.g. RV3 says *levels of intolerance are highest* rather than <u>*we found that*</u> *levels of intolerance are highest*. This means that there is a possibility that readers will not be clear about whether these are your findings or another author's. In RV1 and RV2, this is not a problem because it is a convention to use the PAST SIMPLE (*were*) to talk about your findings. In RV3, the PRESENT SIMPLE (*are*) might seem to indicate that this is established scientific fact, but the reference to Figure 1 indicates that this is your finding and not someone else's.

In any case, you need to make 100% sure that readers will understand whose findings you are talking about. For more on this topic see Chap. 7.

16.12 Summary: How can I assess the quality of my Results section?

To make a self-assessment of your Results section, you can ask yourself the following questions.

- Have I expressed myself as clearly as possible, so that the contribution that my results give stands out for the referees and readers?
- Have I limited myself to only reporting the key result or trends that each figure and table conveys, rather than reiterating each value?
- Have I avoided drawing conclusions? (this is only true when the Results is an independent section)
- Have I chosen the best format to present my data (e.g. figure or table)? Have I ensured that this is no redundancy between the various figures and tables?
- Have I ensured that my tables of results are comprehensive in the sense that they do not exclusively include points that prove my point?
- Have I mentioned only what my readers specifically need to know and what I will subsequently refer to in the Discussion?
- Have I mentioned any parts of my methodology (e.g. selection and sampling procedures) that could have affected my results?
- Have I used tenses correctly? PAST SIMPLE for your findings (in the passive form), PRESENT SIMPLE (descriptions of established scientific fact)

Chapter 17
Discussion

What key skills are needed when writing the Discussion?

People read papers in different ways. Readers in a hurry, may read the title and then just look at the figures! Many begin from the part that they find the most interesting, which is often the Discussion.

Most authors find discussing their results to be the most difficult part of the paper to write. When referees reject a paper, it is very often due to a poorly written Discussion. As one of my PhD students commented:

> It is a 'grey zone' where I have to express my point of view without a specific or logical 'grid'. Writing the introduction is easier because you can be really helped by the articles that you have read.

Although there is no *grid* (i.e. template) in which to insert your own text, there is a general pattern or structure to most Discussions. This chapter is designed to teach you various strategies to simplify the process of discussing your results. You will learn how to structure the Discussion and how to ensure that what you write will satisfy the typical requirements of the referees.

The secret is to sound both convincing and credible at the same time. You can do this by being positive about your own limitations, and constructive when discussing what you believe to be the limitations of others.

Another skill is to interpret your results without repeating them.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_17, © Springer Science+Business Media, LLC 2011

Typical complaints of Referees

The Discussion fails to relate the findings and observations to other relevant studies, and there appears to be no discussion on the implications and limitations of these findings.

The main result of this study was that P = Q. However no exhaustive explanations are given. The authors simply limit the discussion on P by reporting previous findings that are already documented in several papers. I find this kind of discussion too speculative and limited.

The author claims improved efficiency and easy management. However, he did not include any experimental results showing how fast the new system would work (in terms of performance) compared to the traditional method. If the author does not chose to include the actual implementation, this defect can be pointed out in the limitation/future work section as a subsection in the Discussion section.

17.1 How should I structure the Discussion?

The Discussion should answer the following questions, and possibly in the following order. You can thus use the answers to structure your Discussion. This gives you a relatively easy template to follow.

1. Do my data support what I set out to demonstrate at the beginning of the paper?
2. How do my findings compare with what others have found? How consistent are they?
3. What is my personal interpretation of my findings?
4. What other possible interpretations are there?
5. What are the limitations of my study? What other factors could have influenced my findings? Have I reported everything that could make my findings invalid?
6. Do any of the interpretations reveal a possible flaw (i.e. defect, error) in my experiment?
7. Do my interpretations contribute some new understanding of the problem that I have investigated? In which case do they suggest a shortcoming in, or an advance on, the work of others?
8. What external validity do my findings have? How could my findings be generalized to other areas?
9. What possible implications or applications do my findings have? What support can I give for such implications?
10. What further research would be needed to explain the issues raised by my findings? Will I do this research myself or do I want to throw it open to the community?

Whatever your discipline you will need to answer all the questions above, with the possible exception of question 8 (your findings may only be very preliminary). Whether you answer questions 8–10 will depend on whether you have a separate Conclusions section, if so, the Conclusions may be a more appropriate place.

It may make sense for you to organize your Discussion following the same sequence as your presented your findings in the Results section. In this case, you discuss each survey, study or experiment, and interpret it within the overall scenario of the problem.

If you are a medical researcher, you will need to follow closely the appropriate guidelines (e.g. CONSORT, PRISMA, MOOSE, STROKE). Even if you are not a medical researcher these guidelines are still incredibly useful and you can find links to them at bmj.com. The Results and Discussion section of a medical paper typically has the following subsections:

1. Statement of principal findings
2. Strengths and weaknesses of the study
3. Strengths and weaknesses in relation to other studies: important differences in results
4. Meaning of the study: possible explanations and implications for clinicians and policymakers
5. Unanswered questions and future research

The above subsections equally apply to most other disciplines (if you replace *clinicians* with ‘others in my field’). In any case, check out your chosen journal’s website to see if they have similar recommendations on how to structure the Discussion.

17.2 How should I begin the Discussion?

Below are four possible beginnings for the same paper (see Sect. 13.4 for the paper in question).

(1) Remind readers of your goals, preferably in a single sentence:

> One of the main goals of this experiment was to attempt to find a way to predict who shows more task persistence.

(2) Refer back to the questions (hypotheses, predictions etc.) that you posed in your Introduction:

> These results both negate and support some of the hypotheses. It was predicted that greater perfectionism scores would result in greater task persistence, but this turned out not to be the case.

(3) Refer back papers you cited in your Review of the Literature:

> Previous studies conflict with the data presented in the Results: it was more common for any type of feedback to impact participants than no feedback (Shanab et al., 1981; Elawar & Corno, 1985).

(4) Briefly restate the most important points from your Results:

> While not all of the results were significant, the overall direction of results showed trends that could be helpful to learning about who is more likely to persist and what could influence persistence.

You could begin with any of 1–4 above, or perhaps use them all in combination. Next, you give readers a very brief statement of what you can conclude from your findings. You can then use this statement as a starting point for interpreting your findings and comparing them to what is already known in the literature.

Some experts recommend that you tell a story to help you build up your theory, where your variables, data or findings are like characters in a book. Your job as the author is to explain how these 'characters' relate to each other, and how each one has (or has not) its logical place.

17.3 Why should I compare my work with that of others?

Dr Greg Anderson and Dr. Donald Dearborn of Bates College (Maine, USA) give the following advice to their students:

> You may find crucial information in someone else's study that helps you interpret your own data, or perhaps you will be able to reinterpret others' findings in light of yours. In either case you should discuss reasons for similarities and differences between yours and others' findings. Consider how the results of other studies may be combined with yours to derive a new or perhaps better-substantiated understanding of the problem.

A good structure for doing this is:

1. Make a general statement regarding your findings
2. Mention another author's work that relates directly to your findings
3. Make a link between her/his work and your work
4. Clearly state how your work differs from her/his work
5. State the conclusions that can be drawn from your results in light of these considerations

17.4 How should I compare my work with that of others?

The following text is an example of how to compare your work with others in the Discussion. It comes from a paper entitled *Exploring Stock Managers' Perceptions of the Human Animal Relationship on Dairy Farms and an Association with Milk Production* by Catherine Bertenshaw and Peter Rowlinson. See page 313 for a link for downloading the full text. The authors did a postal survey of 516 UK dairy (i.e. milk) stockmanagers (i.e. farmers) about how they believed humans could affect the productivity, behavior and welfare of cows and heifers (young female calves that have not given birth). Nearly half said they called their cows by name – such cows had a 258 liter higher milk yield than those who that were not called by their name. About 10% said that a fear of humans resulted in a poor milking temperament.

Below is the beginning of the Discussion section:

(1) Our data suggests that UK dairy farmers largely regard their cows as intelligent beings, capable of experiencing a range of emotions. Placing importance on knowing the individual animal and calling them by name was associated with higher milk yields.

(2) Fraser and Broom [1997] define the predominant relationship between farm animals and their stock managers as fear.

(3) Seventy-two percent of our commercial respondents thought that cows were not fearful of humans, although their reports of response to an approaching human suggest some level of fear, particularly for the heifers. With both cows and heifers this would appear to be greater in response to an unfamiliar human. Respondents also acknowledged that negative experiences of humans can result in poor behavior in the parlor.

(4) Hemsworth et al. [1995] found that 30–50% of the variation in farm milk yield could be explained by the cow's fear of the stockperson, therefore recognizing that fear is important for animal welfare, safety, and production.

In (1), Catherine begins with an overall summary of her key finding and its implications. In (2) she mentions a previous study (by Fraser) in the same topic area and thus connects her findings with the literature.

Fraser's study gave contrasting results to what Catherine reveals in (3). However, in (3) Catherine also tries to account for some of what Fraser's found (*although … heifers*) and in (4) finds further confirmation of Fraser's findings in another study.

Catherine thus adopts a diplomatic approach in which she questions the findings of other authors in a constructive way. She uses their results either to corroborate her own results, or to put her results and their results in a new light.

Another useful skill that Catherine uses throughout her Discussion, is that she constantly clarifies for the reader between whether she is talking about her findings or those of other authors (Sects. 7.3, 7.4, and 7.7), or whether she is just talking in general,

(5) The elaborated responses reported in *our postal survey* contribute some examples of the capacities of cattle, and this contextual human insight may be useful for developing hypotheses for further study.

(6) Most respondents (78%) thought that cows were intelligent. (7) However, a *study by Davis and Cheek* (1998) found cattle were rated fairly low in intelligence. *They* suggested that the ratings reflected the respondents' familiarity with the animals. (8) The stock managers in *our survey* were very familiar with their cattle and had a great understanding of the species' capabilities, through working with them daily. (9) *Stockpersons' opinions offer* valuable insight into this subject, which could enable more accurate intelligence tests to be devised; for example, to test whether cows can count in order to stand at the feed hopper that delivers the most feed.

(10) Hemsworth and Gonyou (1997) doubt the reliability of an inexperienced stockperson's attitudes towards farm animals. *Our* survey found an experienced workforce (89.5% > 15 years).

In (5) Catherine concludes a paragraph by suggesting a future course of action. (6) is the first line of the next paragraph, so it is clear that the *respondents* are her respondents and not another author's.

In (7) she uses *however* to indicate that she is going to give some contrasting information. Her use of *they* clearly refers back to Davis and Cheek.

In (8) Catherine then clarifies for the reader that she is now focusing on her study. She does this again using *our*. If she had not inserted the phrase "in our survey", the reader would not know which stock managers she was talking about. Not making this distinction is an incredibly common error in Discussions and leads to total confusion for the referee and readers. In the literature *our* is often used, even if the style of the rest of the paper is impersonal (i.e. the passive is used, rather than *we*). Using *our* can be crucial in differentiating your work from others.

In (9), like she does in (5), Catherine makes a mini summary of what she has said in the rest of the paragraph. Her use of the SIMPLE PRESENT (*offer*) shows that she is talking about all stockpersons – not just those in her study or in Davis and Cheek's study. She also recommends a course for future action.

In (10) Catherine begins a new paragraph to indicate that she is now going to cover another subtopic. Good use of paragraphs is essential in signaling to readers that you are moving on to discuss something difference (Sect. 8.2). Catherine begins with a reference to the literature to establish to the new subtopic, and then

immediately moves on to her findings to make a contrast between inexperienced and experienced workers.

The rest of her Discussion is structured in a similar manner, in which she provides more conclusive evidence that calling a cow by its name, rather than problems connected with fear, is more likely to affect milk production. In each case, she makes it 100% clear to her readers why she has mentioned another person's work and how it relates to her work.

17.5 How should I end the Discussion if I do have a Conclusions section?

Discussion sections which also have a Conclusions may end as follows:

(a) Tell your readers if and how your findings could be extended to other areas. But you must provide evidence of this. If you repeated your experiment in a different context, would you get the same result?

> We only a limited number of samples. A greater number of samples could lead to a higher generalization of our results …
>
> Although this is a small study, the results can be generalized to ...
>
> Our results may hold true for other countries in Asia.

(b) Suggest ways that your hypothesis (model, device etc.) could be improved on.

> We have not been able to explain whether x = y. A larger sample would be able to make more accurate predictions.
>
> A greater understanding of our findings could lead to a theoretical improvement in ...

(c) Say if and / or why you ignored some specific areas.

> Our research only focuses on x, whereas it might be important to include y as well. In fact, the inclusion of y would enable us to …
>
> We did not pay much attention to ... The reason for this was ...

(d) Admit what you have not been able to do and as a consequence cannot provide conclusions on.

> Unfortunately, our database cannot tell the exact scale of Chinese overseas R&D investment. Consequently we cannot conclude that …

(e) Reiterate your reasons for choosing your topic of investigation in order to convince your readers of the validity of what you have said in the Discussion.

> As mentioned in the Introduction, so far no one appears to have applied current knowledge of neural networks to the field of mass marketing fraud. The importance of our results using such networks thus lies both in their generality and their relative ease of application to new areas, such as counterfeit products.

The above endings (a–e) are not hugely different from the endings outlined in Sect. 17.4, and may simply be used in addition to, or as an alternative to, those endings.

17.6 How should I end the Discussion if I do not have a Conclusions section?

Whether or not you have a Conclusions section, your Discussion should end with a summary of the main points you want your readers to remember.

Catherine Bertenshaw concludes her Discussion (Sect. 17.4) in the classic way by stating:

(1) what her findings imply

> The attitudinal information from our survey shows that farmers hold cows in very high regard.

(2) what her recommendations are

> These results create a positive profile of the caring and respectful attitudes of UK farmers to their stock, and this image should be promoted to the public further recommendation.

(3) how her research could be continued

> A 56% response rate suggests the respondents are a good representation of UK stock managers. Further on-farm interviews, observations, and animal-centered tests are needed to confirm the inferences made from the data collected in this postal survey.

Many Discussions end in the same way as Catherine's, particularly those that have no Conclusions section. Catherine's paper does in fact have a Conclusions section, but it is only 70 words long and provides an overall summary of her data, and what she thought the implications of her findings might be.

17.7 Active or passive? What kind of writing style should I use?

Before you begin writing, look at your chosen journal to see whether authors use an active/personal or passive/impersonal style (Sect. 7.1). Also, check with the journal's style guide.

In the Discussion you will constantly be comparing your work with other author's. In your head you know what you did, and you know what other authors have done. But the reader doesn't. You need to make a very clear distinction, so that in every sentence the reader is 100% clear about whose work you are referring to (Sects. 7.3, 7.4, 7.7, and 7.8).

Passive sentences do not reveal the author of the action and so the reader will not understand if you are referring to your findings or another person. So, to avoid ambiguity, where possible use active sentences.

The table below shows five examples. The first two make it 100% clear to the reader whose work is being talked about. The other three are in order of decreasing clarity. In the final example the reader has no idea whose work is being discussed - this is a very typical mistake in papers and is a very dangerous way of referring to the literature.

EXAMPLE	COMMENTS
In 2010, *we confirmed* that complex sentences reduce readability [25].	*We* clearly indicates that you are referring to your own work.
In 2011, *Carter suggested* that complex sentences could also lead to high levels of stress for the reader [36].	*Carter*, who is another author, is the subject of the verb. Thus it is clear to the reader that this is not your work.
In 2011, *it was suggested* that complex sentences could also lead to high levels of stress for the reader [Carter, 36].	The passive form means that the reader is not sure until the end of the sentence if it was you or another author. A long literature review or Discussion full of sentences like this is very heavy and annoying for the reader.
In 2011, *it was suggested* that complex sentences could also lead to high levels of stress for the reader [25].	Readers cannot know who made the suggestion unless they go to Ref. 25 and see if it was you or someone else.
In 2011, *it was suggested* that complex sentences could also lead to high levels of stress for the reader.	There is no reference. Readers cannot be sure if you made the suggestion or someone else.

17.8 How can I give my interpretation of my data while taking into account other possible interpretations that I do not agree with?

In a paper that won him an Ignobel Prize, Magnus Enquist made a case for the fact that chickens are able to discriminate between good looking and ugly human beings. Here is an extract of the Discussion section of his paper, *Chickens prefer beautiful humans*.

> (1) We cannot of course be sure that chickens and humans processed the face images in exactly the same way. (2) This leaves open the possibility that, while chickens use some general mechanism, humans possess instead a specially evolved mechanism for processing faces. (3) We cannot reject this hypothesis based on our data. (4) However, there are at least two reasons why we do not endorse this argument. First, it is not needed to account for the data. We believe that the existence of a task-specific adaptation can be supported only with proofs for it, rather than with absence of proofs against. Second, the evolutionary logic of the argument is weak. (5) From observed chicken behaviour and knowledge of general behaviour mechanisms we must in fact conclude that humans would behave the same way with or without the hypothesised adaptation. There would thus be no selection pressure for developing one.

His strategy for anticipating possible objections to his argument is to:

- admit that he might be wrong - sentence (1)
- put forward an alternative interpretation (2)
- reiterate that his data could be used to confirm this alternative interpretation (3)
- give reasons for not agreeing with this alternative interpretation (4)
- propose his own conclusion (5)

See Sects. 8.10, 9.11 and 9.12 to learn the skills reported above.

17.9 How can I bring a little excitement to my Discussion?

Like a verbal discussion, you can make your Discussion quite animated - you can allow yourself to use stronger language and make stronger assertions than you might do in other parts of the paper. You are basically trying to 'sell' your data, but at the same time considering both sides of the issue.

A colleague of mine who is frequently asked to referee papers in his field recommends:

> Be upfront about your findings and achievements. In my work as a referee I often have difficulty in understanding how significant the authors feel their work is, and why their findings add value. This is because authors are not explicit enough – they don't signal to me (and the reader) that they are about to say, or are now saying, something important. The result is that their achievement may be hidden in the middle of a nondescript sentence in a nondescript paragraph … and no one will notice it.

By *upfront*, he means do not be too modest about your findings, and by *nondescript* he means phrases that do not stand out from the rest of the text. If you really want your contribution to be seen and appreciated, then you cannot use the normal flat phrases (Sect. 8.9) that you might use, for example, when describing your materials or methods.

One way to add some passion to your writing, is the very occasional (Sects. 9.2 and 9.4) use of emotive adjectives (Sect. 8.7) and nouns. The adjectives can be qualitative (e.g. *convincing, exciting, indisputable, undeniable*) or quantitative (*huge, massive*). Typical powerful nouns that suggest a major step forward are: *breakthrough, advance, leap*. These adjectives and nouns can also be used in combination (e.g. *a substantial insight, a massive advance*).

Here are some real examples:

S1. These observations provide *compelling evidence* that a *massive* black hole exists at the centre of NGC4258.

S2. It can be stated that these experiments have provided *undeniable evidence* of an autonomic link-up of the limbic area.

S3. The latter finding is *particularly important* in the sense that it cannot readily be explained socioculturally, thus presenting a *new and convincing argument* for brain-based etiology of this disorder.

S4. Major changes in the business processes and the organizational models are, *of course*, *indisputable reasons* for *drastic* decisions regarding the information systems used by the organization.

S5. *To date no work has been published* on the role of circulating miRNAs in breast cancer—an area where, if feasible, their use as *novel* minimally invasive biomarkers would be an *incredible breakthrough* in our management of this disease.

S6. The possibility of contributing to change the way we communicate with machines is a *very exciting proposition*.

My comments below imagine that the authors are describing their own findings or are discussing their own reasoning. However, this does not necessarily reflect how these sentences were in fact used by the authors.

The claim made in S1 is very strong and will certainly attract attention. It could be made softer (weaker) by preceding it with a preliminary statement, as in S2 (*It can be stated that*).

In S3 the authors back up their claim regarding the finding being *particularly important*, by illustrating its importance. There is no point in saying that something is important, without telling your readers why it is important.

S4 adds emphasis to the adjective *indisputable*, by preceding it with *of course*. This makes the claim appear as if it has already been accepted by the community. The adjective *drastic* adds extra power to the sentence.

S5 would work well as a final sentence in the Discussion, or in the Conclusions. Basically, it serves to show how the authors' work in one field could be extended to another field where, to date, it has never been used before.

S6 would be a great final sentence to a paper. It leaves readers feeling upbeat, i.e. optimistic and encouraged. It also leaves referees with a positive final impression of your paper, which may even affect their willingness or not to recommend the acceptance of your paper.

It is best to use this kind of emotive language wisely, and very infrequently (otherwise it loses its effect). Also, such language may not be considered appropriate in your discipline or in your chosen journal – so check with other papers in your journal.

To learn more on highlighting your contribution, and softening strong claims, see Chaps. 8 and 9, respectively.

17.10 How can I use *seems* and *appears* to admit that I have not investigated all possible cases?

It is crucial to be totally honest and non-misleading as to the status of results.

Let's take the example of a mathematical proof. There may be some cases that you have not checked, i.e. you are making an intuitive claim or guess based on what you have checked so far.

In such cases you can use *it appear*s to be or *it seems*. Such phrases say exactly the truth, i.e. that something is true for the cases you have checked. You are telling the reader that you intuitively suspect or expect that it could be always true, but you don't claim it. That is what 'appears' means. You make no assertion as to the probability because you have not computed or assessed a probability.

> *It appears that* stochastic processes for which x = y can produce finite dimension values.
>
> This completes the proof of Theorem 1. Note how this enables us to determine all the Xs and Ys at the same time. Thus *it seems that* some natural hypotheses can be formulated as ..

However, you must make it 100% clear to the reader that, for example, you have not checked all cases, that your sample size was small, and that some external factors may have influenced you results.

17.11 How can I show the pitfalls of other works in the literature?

There are three areas to call into question regarding the work of other authors.

- Hypotheses that have never really been tested. You want to test them.
- Other studies have only been conducted very generally or in one specific field. You want to apply this research to a new area.
- Other studies have limitations. You are trying to overcome these limitations.

The important thing when criticizing other's work is not to undermine their credibility (Sects. 9.11 and 9.12). The idea is that if you treat others with respect, they will treat you with respect.

17.12 How should I discuss the limitations of my research?

It is essential that you inform readers of any limitations to your research or any failures or contradicting data (Sects. 9.9 and 9.10). There is no need to consider these aspects of your research to be totally negative. Your readers will appreciate

learning about what went wrong, as this may help them with their own research.

However, when you discuss any limitations and failures, try to do so in a positive way – not like in S1 below:

S1. *The limitation of this paper is that the two surveys were not conducted in the same period. This will affect our results in terms of ...

S1 is extremely honest, but could be expressed in a way that sounds less negative, as in S2:

S2. Although the two surveys were not conducted in the same period, this will only affect our results in terms of …

The negative impact of S1 is reduced in S2 by:

- removing the word *limitation* - this is not a bad word to use, but if you use it more than once or twice, the reader may go away thinking that your work has more negative aspects than positive ones. If you have to refer to several limitations, another solution to reduce the possible negative effect on the reader is to use synonyms: *shortfall, shortcoming, pitfall, drawback, disadvantage* etc.
- introducing *although* and *only* – these adverbs qualify what you are saying. In this particular case, *although* immediately tells your reader that you are going to say something negative, but that something positive will immediately follow. *Only* implies a limited number of cases, thus it lessens the level of seriousness of the shortcoming
- combining two sentences into one sentence - this gives the reader less time to ponder on the negative content

When you outline the limitations, you also need to be clear what these limitations are and what exactly the implications are. S3 and S4 fail to do this.

S3. *One limitation of our research was the sample size, which was too small.

S4. *The unfortunate contamination of a few of our samples may mean that some of our conclusions are somewhat misleading.

S3 and S4 are not very helpful and are not likely to please your referees. S3 does not explain why and in what way the sample size was too small, nor what the consequences of this were. S4 does not explain why or how the samples were contaminated, nor to what extent the conclusions are misleading.

S5 and S6 provide much more information, and do so in a more positive way that does not undermine your research too dramatically:

S5. One limitation of our research was the sample size. Clearly 200 Xs are not enough to make generalizations about Y. However, from the results of those limited number of Xs, a clear pattern emerged which …

S6. Two of our samples were contaminated. This occurred because … We thus plan to repeat our experiments in future work. However, our analysis of the uncontaminated samples (24 in total) supported our initial hypothesis that …

The important thing is to be (i) honest, (ii) clear, and, if appropriate, (iii) discuss possible remedies.

17.13 What other ways are there to lessen the negative impact of the limitations of my study?

Another way to lessen the impact of the limitations of your findings is to say that other authors have experienced similar problems, as illustrated in the extract below:

> Analytic expressions for the density (1) were not derived, (2) because their interaction depends on the relative orientation of the spheres, (3) thus making integration considerably more complex. (4) Similar complications in the analytical determination of the density, using the same approach that we used, were experienced by Burgess [2011].

The strategy used in the above extract is:

(1) explain the pitfall (i.e. the limitation in your work)
(2) give reason for the pitfall
(3) outline consequence of the pitfall
(4) refer to a similar pitfall experienced by another author

You can also attribute your limitations to the fact that current knowledge (theories, models, technologies etc.) is unable to resolve the problems you have encountered.

> (1) A full treatment of our problem using Gabbertas's theory (GT) is complicated to handle in our case, (2) *given* the complex geometry. (3) *In fact*, the expressions derived by GT are only available for a few simple geometries [Refs]. (4) *Moreover*, GT is not well suited to describing the upper regions. (5) *An additional problem* is that a theoretical description of X is still the target of active experimental and theoretical research. (6) There is little experimental or theoretical information available for the properties of X [Refs]. (7) *At the same time*, the properties of Y can be described by Burgess's model, (8) *however* its ability to well describe X is still under investigation.

The strategy adopted in the above case is:

(1) say that current theories (models etc.) cannot deal with your problem
(2) give an explanation for (1)
(3 + 4) give support for (1)

Note how (5–8) follow the same pattern as (1–4). The author uses link words (highlighted in italics) to give emphasis and logic to her argumentation and she provides variety by using different link words. Note however that excessive use of link words can be very tedious for readers (Sect. 5.6).

Finally, when discussing your limitations, be consistent. Say either *this worked in 75% of cases* (affirmative approach) or *this did not work in 25%* (negative approach), then stick with just one of the two approaches. Otherwise you are in danger of confusing the reader.

17.14 Summary: How can I assess the quality of my Discussion?

When you have finished writing your Discussion, it is a good idea to make sure you can honestly answer 'yes' to all the questions below. This will enable your peers to make a critical assessment with regard to the strengths and weaknesses of (a) how you carried out your research (b) and how you analyzed your findings. The result will be that you will be seen as a credible researcher.

- ➢ Is my contribution to the knowledge gap clear? Have I underlined the significance of my findings?
- ➢ Have I explained what I believe to be new and important very clearly but without exaggerating? Have I ensured that I have not over-interpreted my results (i.e. attributed interpretations to them that cannot actually be supported)?
- ➢ Have I truly interpreted my results, rather than just reiterating them? Have I shown the relationship (confirmation or rejection) between my results and my original hypothesis? Have I generated new theory rather than simply giving descriptions?
- ➢ Is there a good balance, rather than being a one-sided version? Have I really offered alternative explanations?
- ➢ Have I clearly distinguished fact from speculation? Will the reader easily be able to understand when I am merely suggesting a possible interpretation rather than providing conclusive evidence for something?
- ➢ Have I ensured that there is no bias in my research? (i.e. I have not hidden any of my data or any unexpected results, simply because they do not confirm what I was hoping to find)
- ➢ Have I included those works in the literature that do not corroborate my findings? Likewise, have I avoided distorting the magnitude or direction of the data of the literature that I have selected? (i.e. I have made sure that I have not committed publication bias)
- ➢ Have I discussed my findings in the context of what I said in the Introduction? Have I exploited my Review of the Literature?
- ➢ Have I integrated my results with previous research (including my own) in order to explain what I observed or found?
- ➢ Have my criticisms of the literature been justified and constructive?
- ➢ Have I ensured that I have not introduced any new findings (i.e. findings not mentioned in the Results)?
- ➢ Are all the statements I have made in the text supported by the data contained in my figures and tables?
- ➢ Have I removed any trivial information? Have I been as concise as possible?

In addition, remember to make a clear distinction between your work and others but appropriate use of

- *we/our, they/their*
- references in parentheses to the literature
- minimal use of passive form

You can massively improve the structure and the language you use in your Discussion by analyzing how other authors in your field write their Discussion sections. If possible, try to adopt the same approach to analyzing texts as I have used in this chapter.

Chapter 18
Conclusions

What key skills are needed when writing the Conclusions?

One of my PhD students once remarked to me: *I find the conclusions quite difficult to write, even in my own language. If I wrote everything in the paper, what should I add at the end?* Her question sums up the dilemma that authors have with the Conclusions. It's not that the Conclusions section is difficult to write, it's just that authors don't know <u>what</u> to write. In fact, several journals do not even have a separate Conclusions sections, authors simply write a concluding paragraph in their Discussion.

Although the Conclusions may not be the last section that readers read, there is a strong probability that they will be the last thing that the referee reads. Consequently, they must be clear and concise, and leave the referee with a good impression. If your structure and English are poor here then this will have a negative impact on the referees and may affect their final decision as to whether to accept your paper or not.

The key skills are in knowing what referees and readers expect to find in Conclusions, not repeating exactly the same phrases and information from your Abstract and Introduction, and in providing a clear and high-impact take-home message for readers.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_18,

Typical complaints of referees

The Conclusions are just a cut and paste from various other parts of the paper.

The authors have not concluded anything but just given a poor summary of what they have done. Their Conclusions read like someone who would rather be back in the lab, rather than someone who wants readers understand how their investigation may have added to the knowledge base in our field.

The conclusions should be also shortened by avoiding peripheral topics, they did not seem to be the final stone in their build up of logic. I also recommend that the authors should report very clearly why and how these findings may be of interest for future research and applications.

18.1 How should I structure the Conclusions?

The Conclusions section is <u>not</u> just a summary. Don't merely repeat what you said in the Abstract and Introduction. It is generally not more than one or two paragraphs long. A Conclusions section typically incorporates one or more of the following:

1. a very brief revisit of the most important findings pointing out how these advance your field from the present state of knowledge
2. a final judgment on the importance and significance those findings in term of their implications and impact, along with possible applications to other areas
3. an indication of the limitations of your study (though the Discussion may be a more appropriate place to do this)
4. suggestions for improvements (perhaps in relation to the limitations)
5. recommendations for future work (either for the author, and/or the community)
6. recommendations for policy changes

The order these items appear is likely to be the same as suggested above.

It differs from the Abstract and Introduction as it is for a more informed reader. In fact, you are making a summary for readers who hopefully have read the rest of the paper, and thus should already have a strong sense of your key concepts. Unlike the Abstract and Conclusions it:

- does not provide background details
- gives more emphasis to the findings (point 2)
- talks about limitations, which are not normally mentioned outside the Discussion and Conclusions (point 3)
- covers three additional aspects (points 4–6)

On his department's excellent website (see page 313 for a link), Dr Alan Chong of the Faculty of Applied Science and Engineering at the University of Toronto, makes the following comments about the difficulties of writing the Conclusions:

> Students often have difficulty writing the Conclusion of a paper because of concerns with redundancy and about introducing new ideas at the end of the paper. While both are valid concerns, summary and looking forward (or showing future directions for the work done in the paper) are actually functions of the conclusion. The problems then become (1) how to summarize without being completely redundant (2) how to look beyond the paper without jumping completely in a different direction.

The rest of this chapter is dedicated to solving Dr Chong's first problem. The second problem is not a language issue and simply involves making sure that you avoid developing any new directions in significant detail, and that these future avenues should be clearly linked to the work described in your paper.

18.2 How should I begin my Conclusions? How can I increase the impact of my Conclusions?

Here are some beginnings for the Conclusions section. They are typical but in fact make little impact.

S1. We have here described a linear model with an error specification that is considered appropriate for the estimation of … We have found significant evidence of …

S2. In this paper we have presented a statistical study of the nature of … We have shown that it is possible to reason about …

S3. In this paper it has been shown how X can be applied to a wide range of … A novel approach has been introduced to …

S4. In this work it has been attempted to analyze simple feedback loops with … It has been shown that for ...

S1 and S2 use a personal form, S3 and S4 use the passive. What all these examples have in common is that they are boring to read and have almost zero impact on either the referee or the reader. They also match the equally uninteresting first sentences often found in Abstracts (Sect. 12.8).

Just as professional copy editors advise against beginning a paper with *This paper describes*, they also suggest avoiding ending the paper in the same way (*This paper has described*). This is for three reasons:

- they waste a lot of words (5–7 words that tell the reader nothing)
- they delay the main topic
- they are not memorable for the reader and have no impact

It is not difficult to be more direct, as the following examples show.

	ORIGINAL VERSION (OV)	REVISED VERSION (RV)
1	In this study it is concluded that compression plays an important part in … It was found that …	Compression plays an important part in … In fact, it was found that …
2	This work has demonstrated that a number of compounds present in X are responsible for delaying the onset of …	A number of compounds present in X are responsible for delaying the onset of …
3	We have shown that the crystal structure of X reveals that …	The crystal structure of X reveals that …
4	It has been suggested in this paper that the localization of X in neurons is a good marker for neuronal viability.	The localization of X in neurons suggests that it is a good marker for neuronal viability.

The RVs have simply removed the initial 5–8 words of the OVs. This means that the main topic of the paper now appears in the first two to four words of the Conclusions. The result is a Conclusions section that is more concise and has more impact.

The RVs versions are considerably more direct and are found in many disciplines, particularly in medicine and biology related disciplines. If you are worried that they are too direct, then you can make them 'softer' by introducing hedgers (Sects. 9.2–9.6). So RV2 becomes *could be responsible*, and RV3 *seems to reveal* (RV4 already contains the verb *suggest*, which in itself is a good hedger).

In RV4 the passive form (*has been suggested*) has been replaced by an active form (*suggests*) while still maintaining an impersonal construction – this may be important if your journal does not allow you to use *we* (Sect. 7.1). In any case, using the passive form in the Conclusions is perfectly acceptable as it allows you to put your main topic at the beginning of the sentence.

> A simple method of extracting gold from plastic *has been described*.
>
> The gold found in waste materials *has been demonstrated* to produce more than 100 kg of gold per day from a typical recycling plant.

If the above two sentences had appeared in the Introduction, they might have been ambiguous. Given that they are in the passive there is no subject for the verb, so readers cannot be 100% sure if the author is referring to his/her own work or someone else's. However, in the Conclusions such ambiguity rarely arises because the reader is assumed to have read at least some other parts of the paper and thus knows that these are the authors' conclusions about their own work.

18.3 How can I differentiate my Conclusions from my Abstract?

In this section I am going to analyze an example from a writing skills exercise I set my PhD students. Below are an Abstract and Conclusions by Chiara Vallebona. She uses a model to predict how very heavy rain will erode soil in the near future. Note that the data presented below are completely hypothetical as no such study has actually been conducted.

Here is how Chiara begins her Abstract and Conclusions.

> ABSTRACT An increase in storm frequency and intensity is expected for the Mediterranean area. The aim of this study is to assess the risk of soil erosion in sub-basin croplands in Tuscany, Italy.
>
> CONCLUSIONS We assessed the risk of soil erosion in the Trasubbie (*Tuscany, Italy*) sub-basin croplands by using a scenario analysis.

The main topic (*the risk of soil erosion*) is the same in both sections, but the focus is different. In the first sentence of the Abstract, Chiara gives some background information. In the Conclusions, there is no background information. Instead in the first sentence of the Conclusions, Chiara summarizes the main activity of her research. In the Abstract, she mentions the location as a wide area (Tuscany, Italy), which she

thinks her readers will be familiar with. In the Conclusions she is more precise about this location (Trasubbie, a much smaller land area in Tuscany) – readers will have read the paper at this point so this precise location makes sense. Her Abstract and Conclusions then continue as follows.

> ABSTRACT We explored the potential response of soil erosion patterns to changes in temporal distribution and intensity of rainfall events, land-use, and soil conservation management practices by analyzing various scenarios. Most soil erosion is associated with a limited number of intensive-to-extreme rainfall events. Assessing the spatially-distributed soil loss due to intensive rainfall may help in predicting long-term soil erosion rate in order to implement efficient soil conservation management. An analysis on a sub-hourly basis was carried out using the SWAT model.

> CONCLUSIONS Various combinations for climate change (intensity and distribution of rainfall events), land use change, and conservation measures were evaluated using the SWAT model.

In the first sentence of Chiara's Abstract she gives more details about what she did during her research. In the second sentence she also provides more background information. In the third sentence she justifies the reason for her research. And in the fourth sentence she indicates what model she used to carry out this research. Her Conclusions summarize all these four points in one sentence. Her Abstract and Conclusions then end as follows.

> ABSTRACT Our analysis highlighted three specific management strategies that may help in preventing or reducing cropland erosion. We predict that these strategies could reduce erosion by up to 25% in the studied area over the next ten years.

> CONCLUSIONS The result was a range of possible erosion values for the next ten years – the worst possible scenario indicated a possible erosion rate increase of up to 25%. In the light of these dramatic findings, we believe that our analysis may contribute to implementing ad-hoc land management strategies to reduce, or even completely prevent, cropland erosion. We hope that our findings may influence policy planning. Future work will entail refining our model by exploiting data from satellite sensors (e.g. InSAR).

The differences in the way that her two sections end are that her Conclusions:

- use phrases to describe the results that have a much stronger impact (*dramatic findings*, *even completely prevent*)
- make recommendations for policy change – this helps give the conclusions more substance and authority
- indicate future work and how Chiara plans to conduct such work

So what are the main differences between the Abstract and the Conclusions? The two sections have completely different purposes. The Abstract is like an advertisement for your paper – it has to attract the reader's attention. On the other hand, the Conclusions section is designed to remind readers of the most salient points of your paper. However, the Conclusions also have to add value. This added value is typically contained in the recommendations, implications and areas for future research.

In any case, it is a good idea to revise the Abstract and Conclusions together, and even shift information from one to the other.

Inevitably there will be some overlap between the two sections, but this is both accepted practice and inevitable. An analysis of the Chiara's Abstract and Conclusions, highlights that:

- they are similar in length: Abstract (152 words) and Conclusions (125 words) – these relative lengths are fairly typical in research papers
- each contains at least 20% different vocabulary – there are 34 words in the Abstract that do not appear in the Conclusions, and 33 words in the Conclusions that do not appear in the Abstract
- words that are unique to the Conclusions include words that indicate findings, possibility and the future (*believe*, *could, findings, help, planning, policy, predict, refining, result will*) and specific words (*EU, InSAR, satellite, Trasubbie*), and emotive words (*completely, dramatic, worst*)

18.4 How can I differentiate my Conclusions from my Introduction and from the last paragraph of my Discussion?

The same comments made in Sect. 18.3 regarding the difference between the Abstract and the Conclusions, are also substantially the same as for the Introduction, so they are not worth repeating.

If your journal has a separate section for Conclusions, i.e. the conclusions are not included in the Discussion, then it may be best to shift any overall conclusions you may have made in your Discussion into your Conclusions. This means that the final paragraph of your Discussion may just be a conclusion regarding one specific point, rather than an overall summary of the whole paper. See Sects. 17.5 and 17.6 for more on this aspect.

18.5 I don't have any clear Conclusions, what can I do?

Sometimes it is impossible to leave the reader with clear conclusions regarding the contribution of your work – maybe your method turned out to be inappropriate and your results were not as brilliant as you were hoping for! In such cases simply say what you have learned about the problem and then suggest possible lines of future research. Such a final section is generally entitled Concluding Remarks.

If you don't have any clear conclusions, it is important not to present your findings in an exaggerated light or to say something uninteresting or irrelevant. Readers may

still be able to benefit from what you found (or equally important, did not find). In order to present inconclusive conclusions you may benefit from using hedging devices (Sects. 9.2–9.6).

Here are some examples of authors admitting that their work did not achieve all that they had hoped for. In some cases readers are immediately warned of this 'failure' through the use of the words highlighted in italics.

Unfortunately, we could not assess how much of the difference in outcome was due to ..

When results are compared across different components, the confidence intervals overlap, and we have no conclusive evidence of differences in ...

Although some progress has been made using our model, this incremental approach provides only a partial answer

Unfortunately this trial had too few subjects to achieve sufficient power and had a low …

It is also unclear what conclusion should be drawn …

Regrettably, we did not have the means to …

To make your Conclusions not sound too negative, you can add some hope for the future.

Although it is too early to draw statistically significant conclusions, two patterns seem to be emerging …

However, more definite conclusions will be possible when ...

Nevertheless, our study confirms recent anecdotal reports of …

Despite this, our work provides support for …

In any case, we believe that these preliminary results indicate that …

Again, the first words of the sentence alert the reader that you are now going to qualify the negative stuff you said before by offering some optimism. You could also use some conditional sentences to show what might have been possible if you had had different circumstances, or what might be possible in the future.

If we had managed to … then we might have been able to …

If we manage to … then we might be able to.

18.6 How can I end my Conclusions?

Once you have summarized your work and dealt with any limitations, there are three typical ways to end your Conclusions. You can use one or more of these ways.

The first is to show how your work could be applied in another area.

Our findings could be applied quite reliably in other engineering contexts without a significant degradation in performance.

These findings could be exploited in any situation where predictions of outcomes are needed.

Our results could be applied with caution to other devices that …

Note how the above phrases all make use of *could* as a hedging device (Sect. 9.6).

You might however like to say where they could not be applied for the moment.

However, it remains to be further clarified whether our findings could be applied to …

Further studies are needed to determine whether these findings could be applied to components other than those used for …

The second typical ending is to suggest future work. There is some general agreement that the use of *will* refers to your own planned work, and that *should* refers to work that you believe could be addressed by the general community. Thus the following represent the authors' plans:

One area of future work *will* be to represent these relationships explicitly …

Future work *will* mainly cover the development of additional features for the software, such as …

Future work *will* involve the application of the proposed algorithm to data from …

On the other hand, these examples show possible lines of research for anyone in this particular field:

Future work *should* give priority to (1) the formation of X; (2) the interaction of Y; and (3) the processes connected with Z.

Future work *should* benefit greatly by using data on …

The third way to end your Conclusions is to make a recommendation. The difficulty in making suggestions and recommendations is just in the grammatical construction. The examples below highlight a construction that may not exist in your language.

S1. We suggest that policy makers *should give* stakeholders a greater role in …

S2. We suggest that policy makers *give* stakeholders a greater role in …

S3. We suggest that the manager *giv*e stakeholders a greater role in …

S4. We recommend that stakeholders *should be given* a great role in …

S5. We recommend that stakeholders *be given* a greater role in …

The construction is thus:

to *recommend* (*suggest, propose*) + *that* + someone or something + *should* (optional) + infinitive (without *to*) + something

The only difference between S1 and S2, and between S4 and S5 is the use and non-use of *should* - the meaning is identical. S3 highlights that the form of the second verb does not change – in fact it is an infinitive form (or if you a language

expert, the present subjunctive). This means that in correct English no third person *–s* is required, so *we suggest that the manager gives* is incorrect (but still quite common). S4 and S5 use the passive infinitive (*be*) + past participle (*given*).

18.7 What tenses should I use?

Many tenses and constructions are used in the Conclusions – the future, conditionals, modal verbs etc. For details on how to use these forms see the companion volume English for Research: Usage, Style, and Grammar.

One distinction that many authors make is between what they did during the research (SIMPLE PAST) and what they did during the writing process of the manuscript (PRESENT PERFECT).

> We *have described* a method to extract gold from plastic. We *used* this method to extract 5 kg of gold from 50 kg of plastic. We *found* that the optimal conditions for this process were …

The first verb (*have described*) says what the authors have done in the paper, whereas the second and third verbs (*used, found*) say what they did in the laboratory (i.e. a finished action).

The following two sentences are incorrect because they use the PRESENT SIMPLE instead of the PRESENT PERFECT:

S1. *In this paper we *consider* the robust design of an extractor for removing gold from plastic.

S2. *In this study, it *is demonstrated* that by using an ad hoc extractor gold can be easily removed from plastic.

S1 and S2 would be correct in the Abstract or Introduction.

18.8 Summary: How can I assess the quality of my Conclusions?

To make a self-assessment of your Conclusions, you can ask yourself the following questions.

- Is what I have written really a Conclusions section? (If it is more than 200–250 words, then it probably isn't – it needs to be much shorter)
- If the conclusions are included in the Discussion, have I clearly signaled to the reader that I am about to discuss my conclusions (e.g. by writing *In conclusion …*)?
- Have I given a maximum of one line to comments related to descriptions of procedures, methodology, interviews etc.? (Generally such comments are not needed at all, unless the primary topic of your paper is the methodology itself)
- Have I avoided cut and pastes from earlier sections? Do my Conclusions differ appropriately from my Abstract, Introduction and final paragraph of my Discussion?
- Are my Conclusions interesting and relevant?
- Have I given my Conclusions as much impact as possible and have I avoided any redundant expressions?
- Have I avoided any unqualified statements and conclusions that are not completely supported?
- Is my work as complete as I say it is? (i.e. I am not trying to get priority over other authors by claiming inferences that cannot really be drawn at this stage)
- Have I introduced new avenues of potential study or explained the potential impact of my conclusions? Have I ensured that I have only briefly described these future avenues rather than getting lost in detail?
- Are the possible applications I have suggested really feasible? Are my recommendations appropriate?
- Have I used tenses correctly? PRESENT PERFECT (to describe what you have done during the writing process), PAST SIMPLE (what you did in the lab, in the field, in your surveys etc.)

In addition, you should look at the summary questions for the Discussion (Sect. 17.14), as these may also be helpful in deciding whether your Conclusions will have the necessary impact on your readers.

Chapter 19
Useful Phrases

Why is this chapter important?

Many non-native researchers begin their writing career by reading extensively about their topic in English, and noting down useful generic phrases that they can then 'paste' into their own work (see Chap. 1). You can use such phrases as a template / structure for your paper into which you insert your own data. You at least know that these ready-made phrases are in correct English. You do not risk being accused of plagiarism (see Chap. 10) because of the very generic nature of the phrases.

This chapter presents lists of frequently used phrases that have a general acceptance in all disciplines that you can use in specific sections of your paper. This means that they are phrases that referees and readers frequently encounter, and this will help to describe your findings using conventional language. This is important as referees and readers do not want to be disturbed by strange expressions that could easily be replaced by one of the standard phrases given in this chapter.

The lists are not comprehensive and you should try to add other useful phrases that frequently occur in your field.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_19, © Springer Science+Business Media, LLC 2011

What the experts say

As with most types of language production, academic writing is characterized by a significant number of preconstructed or semi-preconstructed phrasal elements. These are mostly learnt and retrieved from memory as wholes. For non-native speakers, lists of these elements, organised according to the function they serve in text, can play a useful role in supporting and developing good writing.

Dr John Morley, Director of University-wide Language Programmes at the University of Manchester, and author of the "Phrase Bank"

When your language skills are not perfect, organizing your information in a conventional way and using conventional language are very important.

Hilary Glasman-Deal, trainer in science research writing at Imperial College London, and author of "Science Research Writing For Non-Native Speakers of English"

I learned to write engineering papers in English by collecting useful phrases from every article in English that I read. I have used these phrases throughout my career in academia, and I believe that they have served both me and my students very well.

Professor Antonio Strozzi, author of "How to Write a Technical Paper in English - A Repertoire of Useful Expressions"

19.1 Index of Useful Phrases

1. Establishing why your topic (X) is important
2. Outlining the past-present history of the study of X (no direct references to the literature)
3. Outlining the possible future of X
4. Indicating the gap in knowledge and possible limitations
5. Stating the aim of your paper and its contribution
6. Explaining the key terminology in your field
7. Explaining how you will use terminology and acronyms in your paper
8. Giving the structure of paper - what is and is not included
9. Giving general panorama of past-to-present literature
10. Reviewing past literature
11. Reviewing subsequent and more recent literature
12. Reporting what specific authors of have said
13. Mentioning positive aspects of others' work
14. Highlighting limitations of previous studies - authors not mentioned by name
15. Highlighting limitations of previous studies - authors mentioned by name
16. Using the opinions of others to justify your criticism of someone's work
17. Describing purpose of testing / methods used
18. Outlining similarities with other authors' models, systems etc.
19. Describing the apparatus and materials used and their source
20. Reporting software used
21. Reporting customizations performed
22. Formulating equations, theories and theorems
23. Explaining why you chose your specific method, model, equipment, sample etc.
24. Explaining the preparation of samples, solutions etc.
25. Outlining selection procedure for samples, surveys etc.
26. Indicating the time frame (past tenses)
27. Indicating the time frame in a general process (present tenses)
28. Indicating that care must be taken
29. Describing benefits of your method, equipment etc.
30. Outlining alternative approaches
31. Explaining how you got your results
32. Reporting results from questionnaires and interviews
33. Stating what you found
34. Stating what you did not find
35. Highlighting significant results and achievements
36. Stating that your results confirm previous evidence
37. Stating that your results are in contrast with previous evidence
38. Stating and justifying the acceptability of your results
39. Expressing caution regarding the interpretation of results
40. Outlining undesired or unexpected results
41. Admitting limitations
42. Explaining and justifying undesired or unexpected results
43. Minimizing undesired or unexpected results
44. Expressing opinions and probabilities
45. Announcing your conclusions and summarizing content
46. Restating the results (Conclusions section)
47. Highlighting achievements (Conclusions section)
48. Highlighting limitations (Conclusions section)
49. Outlining possible applications and implications of your work
50. Future work already underway or planned by the authors
51. Future work proposed for third parties to carry out

52. Acknowledgements
53. Referring to tables and figures, and to their implications
54. Making transitions, focusing on a new topic
55. Referring backwards and forwards in the paper
56. Referring back to your research aim
57. Referring outside the paper

19.2 How to use the Useful Phrases

Where possible the order of the useful phrases given in this chapter reflects the order that they might appear in a paper, and within a section. Thus the phrases should help you to structure each section.

The same phrases may be needed in several sections of your paper. Below I have suggested which phrases you might need in each section.

Abstract	1, 5 and possibly 2–4
Introduction	1–8, 9–16
Literature review	4, 9–16
Methods	17–30
Results	29–40
Discussion	35–45
Conclusions	45–51
Acknowledgements	52

There are also five other subsections (53–57) on how to make references to other parts of your paper and to documents outside your paper.

Words and phrases between slashes (/) indicate various ways the sentence could be composed. The ways suggested are not exhaustive. A slash does not always indicate synonymous expressions, but simply words and phrases that are likely to be used in a similar context. You are advised to consult a bilingual dictionary to help you to differentiate the differences between the words and phrases given.

In some cases words and phrases have an identical meaning. For example, when used with reference to figures and tables, there is little, if any difference in meaning between verbs such as *shows, reports* and *highlights*. However, some words apparently seem to be synonyms, but may have specific or subtle differences in your field. For example, the following groups of generally have distinct meanings:

argue, assert, claim, state

assume, hypothesize, suggest

find, discover

demonstrate, prove, test

If you have checked that a word or phrase really has the same meaning, I suggest you choose the shortest option. For example choose:

Since x = y …

Although x = y …

Rather than

Given the fact that x = y …

Despite the fact that x = y …

Notwithstanding the fact that x = y …

Of course, if you need to use the same type of phrase on several occasions, then you can use the longer constructions too.

Your choice of phase will often depend on what style of writing you are using: the passive (e.g. *it was found*) or personal forms (i.e. *we, I*). This choice will itself depend on what your journal requires (see Sect. 7.1). In any case, if you have opted for a personal style, I suggest that in any case you use some passive forms to create variety in your writing.

A very comprehensive collection of useful phrases plus related advice can be found at http://www.phrasebank.manchester.ac.uk/. The phrases were compiled by Dr John Morley, Director of University-wide Language Programmes at the University of Manchester. Some of the phrases below have been adapted from that collection.

Finally, if you have the electronic version of this book, you can easily make searches within this chapter. You can also search and check for phrases using Google Scholar.

1. Establishing why your topic (X) is important

   X is the main / leading / primary / major *cause of* ..

   Xs are a common / useful / critical *part of…*

   Xs are among the most widely used / commonly discussed / well-known / well-documented / widespread / commonly investigated *types of* …

   X is recognized as being / believed to be / widely considered to be *the most important* …

   It is well known / generally accepted / common knowledge *that X is* …

   X is increasingly becoming / set to become *a vital factor in* …

   Xs are undergoing a revolution / generating considerable interest *in terms of* …

   Xs are attracting considerable / increasing / widespread *interest due to* …

   X has many uses / roles / applications *in the field of* …

   A striking / useful / remarkable *feature of* …

   The main / principal / fundamental *characteristics of X are:*

   X accounts / is responsible *for*

2. Outlining the past-present history of the study of X (no direct references to the literature)

   Last century X was considered to be / viewed as / seen as *the most* …

   Initial / Preliminary / The first *studies of X considered it to be*

Traditionally X / In the history of X, *the focus has always been …*

Scientists / Researchers / Experts *have always seen X as …*

Until now / For many years / Since 1993 *Xs have been considered as …*

X has received much attention in the last two years / in the past decade / over the last two decades …

For the past five years / Since 2011 *there has been a rapid rise in the use of Xs*

The last two years have witnessed / seen *a huge growth in X …*

The *past decade* / *last year* has seen a renewed importance in X …

Recent developments in / findings regarding *X have led to …*

X has become a central / an important / a critical *issue in …*

3. Outlining the possible future of X

The next decade is likely to see / witness *a considerable rise in X*

In the next few years X will become / is likely to have become

Within the next few years, X is set / destined / likely *to become an important component in …*

By 2025 / Within the next ten years, *X will have become …*

X will soon / shortly / rapidly / inevitably *be an issue that …*

4. Indicating the gap in knowledge and possible limitations

Few researchers have addressed the problem / issue / question *of …*

Previous work has only focused on / been limited to / failed to address …

A basic / common / fundamental / crucial / major *issue of …*

The central / core *problem of*

A challenging / An intriguing / An important / A neglected *area in the field of …*

Current solutions to X are inconsistent / inadequate / incorrect / ineffective / inefficient / over-simplistic / unsatisfactory

Many hypotheses regarding X appear to be ill-defined / unfounded / not well grounded / unsupported / questionable / disputable / debatable

The characteristics of X are not well understood / are misunderstood / have not been dealt with in depth.

It is not yet known / has not yet been established *whether X can do Y.*

X is still poorly / not widely *understood.*

X is often impractical / not feasible / costly …

Techniques to solve X are computationally demanding / subject to high overheads / time consuming / impractical / frequently unfeasible.

A major defect / difficulty / drawback / disadvantage / flaw *of X is …*

One of the main issues in our knowledge of / what we know about *X is a lack of …*

This particular / specific *area of X* has been overlooked / has been neglected / remains unclear …

Despite this interest, no one to the best of our knowledge / as far as we know *has studied …*

Although this approach is interesting, it suffers from / fails to take into account / does not allow for …

In spite of / Despite *its shortcomings, this method has been widely applied to …*

However, there is still a need for / has been little discussion on …

Moreover, other solutions / research programs / approaches *have failed to provide …*

Most studies have only focused / tended to focus *on …*

To date / Until now *this methodology has only been applied to …*

There is still some / much / considerable *controversy surrounding …*

There has been some disagreement concerning / regarding / with regard to *whether*

There is little / no general agreement *on …*

The community has raised some issues / concerns *about …*

Concerns have arisen / been raised *which* question / call into question *the validity of …*

In the light of recent events in x, there is now some / much / considerable *concern about …*

5. Stating the aim of your paper and its contribution

   In this report / paper / review / study *we …*

   This paper outlines / proposes / describes / presents *a new approach to …*

   This paper examines / seeks to address / focuses on / discusses / investigates *how to solve …*

   This paper is an overview of / a review of / a report on / a preliminary attempt to …

   The present paper aims to validate / call into question / refute *Peng's findings regarding …*

   X is presented / described / analyzed / computed / investigated / examined / introduced / discussed *in order to …*

   The aim of our work / research / study / analysis *was to* further / extend / widen / broaden *current knowledge of …*

   Our knowledge of X is largely based on very limited data. The aim of the research was thus / therefore / consequently *to*

   The aim of this study is to study / evaluate / validate / determine / examine / analyze / calculate / estimate / formulate …

   This paper calls into question / takes a new look at / re-examines / revisits / sheds new light on …

   With this in mind / Within the framework of these criteria / In this context *we tried to …*

   We undertook this study / initiated this research / developed this methodology *to …*

   We believe that we have found / developed / discovered / designed *an innovative solution to …*

   We describe / present / consider / analyze *a* novel / simple / radical / interesting *solution for …*

6. Explaining the key terminology in your field

   The term 'X' is generally understood to mean / has come to be used to refer to / has been applied to …

   In the literature, *X* usually refers / often refers / tends to be used to refer *to …*

   In the field of X, several / various / many *definitions of Y can be found.*

   The term X is / was / has been *used by Molotov [2011] to refer to …*

   Molotov uses the term X [2011] to refer to / denominate …

   X is defined by Peng [1990] to refer to / to mean …

   Vitous [2015] has provided / put forward / proposed *a new definition of X, in which …*

   X is defined / identified / described *as … [Njimi 2004].*

   In the literature there seems to be no general definition of X / a general definition of X is lacking / there is no clear definition of X.

   Several authors have attempted to define X, but as yet / currently / at the time of writing *there is still no accepted definition.*

   In broad / general *terms*, *X* is / can be defined as *a way to …*

   The broad / general / generally accepted *use of the term X refers to …*

   X is sometimes *equated with / embodies* a series of …

   X, Y and Z are three kinds / types / categories / classes *of languages.*

There are three kinds of languages: / The three kinds of languages are: / Languages can be divided into three kinds: *X, Y and Z.*

7. Explaining how you will use terminology and acronyms in your paper

   The acronym PC stands for / denotes …

   The subjects (*henceforth named / hereafter* 'X') are…

   The subject, which we shall call / refer to *as 'X', is …*

   Throughout this paper / section *we use the terms 'mafia' and 'the mob' interchangeably*, following / in accordance with *the practice of this department where this study was conducted.*

   The fonts, i.e. / that is to say *the form of the characters, are of various types.*

   There are three different types, namely / specifically: *X, Y and Z.*

   Throughout the / In this *paper we* use / will use *the term X to refer to …*

   In this chapter X is used / will be used to *refer to …*

   In this paper the standard meaning of X is / will be *used ..*

   This aspect is / will be dealt *with in more detail in Sect. 2.*

   We will see / learn / appreciate *how relevant this is in the next subsection.*

8. Giving the structure of paper - what is and is not included

   This paper is organized as follows / divided into five sections.

   The first section / Section 1 *gives a brief overview of …*

   The second section examines / analyses …

   In the third section a case study is presented / analyzed …

   A new methodology is described / outlined *in the fourth section …*

   We / I *propose a new procedure in Section 4.*

   Some / Our *conclusions are drawn in the final section.*

   This paper / chapter / section / subsection *begins by examining …*

   The next chapter looks at / examines / investigates *the question of …*

   Problems / Questions / Issues *regarding X are discussed in later sections.*

   A discussion of Y is / falls outside *the scope of this paper.*

   For reasons of space, Y is not addressed / dealt with / considered *in this paper.*

9. Giving general panorama of past-to-present literature

   There is a considerable / vast *amount of literature on …*

   In the literature there are many / several / a surprising number of / few *examples of …*

   What we know / is known *about X is largely based on …*

   Much / Not much / Very little *is known about …*

   Many / Few *studies have been published on* … [Ref]

   Various approaches have been proposed / put forward / suggested / hypothesized *to solve this issue [Ref].*

   X has been identified / indicated *as being* … [Ref]

   X has been shown / demonstrated / proved / found *to be … [Ref]*

   X has been widely investigated / studied / addressed … *[Ref]*

   Xs have been receiving / gaining *much attention due to …*

   In the traditional / classical *approach, X is used to …*

   In recent years there has been considerable / growing *interest in … [Ref*]

A growing body of literature has examined / investigated / studied / analyzed / evaluated … *[Ref]*

Much work on the potential of X has been carried out [Ref], yet / however *there are still some critical issues … [Ref]*

10. Reviewing past literature

In their seminal / groundbreaking / cutting edge *paper of 2001, Peters and Jones …*

Initial / Preliminary *work in this field focused primarily on …*

Some preliminary work was carried out in the early 1990s / several years ago …

Doyle in 2000 was among / one of *the first to …*

The first investigations into / studies on *X found that …*

The first systematic study / report *on X was* carried out / conducted / performed *in 1995 by …*

An increase in X was first noted / reported / found *by …*

11. Reviewing subsequent and more recent literature

Experiments on X were conducted / carried out / performed on *X in 2009 by a group of researchers from …*

In a major advance in 2010, Berlusconi et al. surveyed / interviewed …

Jeffries and co-workers [2011] measured / calculated / estimated …

In [67] the authors investigated / studied / analyzed …

A recent review of the literature on this topic / subject / matter / area *[2012] found that …*

A number / An increasing number *of studies have found that …*

Since 2011 / In the last few years*, much more information on X has become available …*

Several studies, for example / instance *[1], [2], and [6],* have been carried out / conducted / performed *on X.*

More recent evidence [Obama, 2013] shows / suggests / highlights / reveals / proposes *that …*

It has now been suggested / hypothesized / proposed / shown / demonstrated *that … [Cosimo 2010]*

Many attempts have been made [Kim 2009, Li 2010, Hai 2011] in order to / with the purpose of / aimed at …

12. Reporting what specific authors of have said

In her analysis / review / overview / critique *of X, Bertram [2] questions the need for …*

In his introduction to / seminal article on / investigation into *X, Schneider [3] shows that …*

*Dee [*4] developed / reported *on a new method for X and concluded that …*

Southern's group [5] calls into question some past assumptions / hypotheses / theories *about X.*

Burgess [6], an authority on X, notes / mentions / highlights / states / affirms *that …*

She questions / wonders / considers / investigates *whether [or not] X can …*

He traces the advances in / development of / history of / evolution of *X*

They draw our attention to / focus on *X.*

They make / draw *a distinction between …*

He claims / argues / maintains / suggests / points out / underlines *that …*

She concludes / comes to the conclusion / reaches the conclusion *that …*

She lists / outlines / describes / provides *several reasons for …*

Her theory / solution / proposal / method / approach *is based on …*

13. Mentioning positive aspects of others' work

    Smith's [22] use of X is fully justified / very plausible / endorsed by experience.

    Kamos's [23] assumptions seem to be realistic / well-founded / well-grounded / plausible / reasonable / acceptable.

    The equations given in [24] are accurate / comprehensive …

    It has been suggested [25] that … and this seems to be a reliable / useful / innovative *approach …*

14. Highlighting limitations of previous studies - authors not mentioned by name

    Research has tended to focus on X rather than Y. An additional problem is that / Moreover *X is …*

    The main limitation / downside / disadvantage / pitfall / shortfall *of X is …*

    One of the major drawbacks to adopting / using / exploiting *this system is …*

    This is something of a pitfall / disadvantage …

    A well-known / major / serious *criticism of X is …*

    A key problem with much of the literature on / regarding / in relation to *X is that …*

    This raises many questions *about / as to / regarding* whether X should be used for …

    One question / issue *that needs to be* asked / raised *is …*

    Unfortunately, it does not / fails to / neglects to *explain why …*

    This method suffers from a number / series / plethora *of pitfalls.*

    There is still considerable ambiguity / disagreement / uncertainty *with regard to …*

    Many experts contend, however / instead / on the other hand, *that this evidence is not conclusive.*

    A related hypothesis holds / maintains *that X is equal to Y,* suggesting / indicating *that …*

    Other observations indicate / would seem to suggest *that this explanation is insufficient …*

15. Highlighting limitations of previous studies - authors mentioned by name

    Peng [31] claimed / contended *that X is … but she failed to provide adequate proof of this finding.*

    Peng's findings do not seem / appear *to support his conclusions.*

    This has led authors such as / for example / for instance *Mithran [32], Yasmin [34] and Hai [35] to investigate ..*

    The shortcomings / pitfalls / flaws *of their method have been clearly recognized.*

    A serious weakness / limitation / drawback *with this argument, however, is that …*

    Their approach is not well suited to / appropriate for / suitable for …

    The main weakness in their study is that they make no attempt to … / offer no explanation for … / they overlook …

    Their experiments were marred / flawed / undermined *by X.*

    X is the major flaw in / drawback to / disadvantage of *their experiments.*

    The major defect in their experiments is that they entail tedious / repetitive / time-consuming / laborious / labor-intensive *calculations with regard to …*

    Such an unreasonable / unjustified / inappropriate / unsuitable / misleading assumption *can lead to* serious / grave *consequences with regard to …*

    Their claims seem to be somewhat exaggerated / inaccurate / unreliable / speculative / superficial …

In our view, their findings are only conjectures / speculations *based on* unjustified / implausible / unsatisfactory / ambivalent / unsubstantiated *assumptions.*

Their paper / work / study / research / approach / findings / results *might have been more* interesting / innovative / useful / convincing / persuasive if …

Their attempts to do X are cumbersome / unnecessarily complicated / financially unfeasible …

Their explanations are superficial / impenetrable / doubtful / confusing / misleading / irrelevant …

Another / An additional *weakness is* …

An even greater source of concern / issue / problem *is* …

16. Using the opinions of others to justify your criticism of someone's work

As mentioned by Burgess [2011], Henri's argument / approach / reasoning *relies too heavily on* …

As others have highlighted [34, 45, 60], Ozil's approach raises many doubts / is questionable …

Several authors / experts / researchers / analysts *have* expressed doubts about / called into question / challenged *Guyot on the grounds that* …..

Marchesi [2010] has already noted an inconsistency with Hahn's claim / methodology / method / results / approach …

Friedrich's approach [2013] has not escaped criticism / been subjected to much criticism *and has been* strongly / vigorously *challenged* …

Many experts now contend / believe / argue *that rather than using Pappov's approach it might be more useful to* …

Their analysis has not found / met with / received *general acceptance* …

Some recent criticisms of / critical comments on *Kim's work are summarized in [25].*

The most well-known critic of Sadie's findings is … who argued / proposed / suggested *that an alternative explanation* might be that / could be found in …

17. Describing purpose of testing / methods used

In order to identify / understand / investigate / study / analyze *X* …

To enable / allow *us to … , we …*

To see / determine / check / verify / determine *whether* …

To control / test *for X, Y was done.*

So that we could / would be able to *do X, we* …

In an attempt / effort *to do X, we* …

X was done / We did X *in order to* …

18. Outlining similarities with other authors' models, systems etc.

The set up we used can be found / is reported / is detailed *in [Ref 2].*

Our experimental set up bears a close resemblance to / is reminiscent of / is based on / is a variation on / was inspired by / owes a lot to / is more or less identical to / is practically the same as *the one proposed by Smith [2014].*

We used a variation of Smith's procedure. In fact / Specifically, *in our procedure we* …

Our steps proceed very much in the same way as / follow what is *indicated in [Ref. 2]. First,* …

The procedure used is as described / explained / reported / proposed *by Sakamoto [2013].*

The method is in line with a variation of / essentially the same as *that used by Kirk [2009] with some* changes / modifications / alterations / adjustments.

We refined / altered / adapted / modified / revised *the method* used / reported / suggested / explained / proposed / put forward *by Bing [2012].*

Our technique was loosely / partially / partly / to some extent *based on …*

More details can be found / are given *in our previous paper [35].*

This component is fully compliant with international norms / regulations / standards.

19. Describing the apparatus and materials used and their source

    The instrument used / utilized / adopted / employed *was* …

    The apparatus consists of / is made up of / is composed of / is based on …

    The device was designed / developed / set up *in order to* …

    X incorporates / exploits / makes use of *the latest technological advances*.

    The system comes complete / is equipped / is fully integrated / is fitted *with a* …

    It is mounted on / connected to / attached to / fastened to / fixed to / surrounded by / covered with / integrated into / embedded onto / encased in / housed in / aligned with …

    It is located in / situated in / positioned on ….

    X was obtained from / supplied by *Big Company Inc*.

    X was kindly provided / supplied *by Prof Big.*

20. Reporting software used

    The software application / program / package *used to analyze the data was SoftGather (Softsift plc, London).*

    The data were obtained / collected *using SoftGather.*

    Data management / analysis *was performed* by / using *SoftGather.*

    X was carried out / performed / analyzed / calculated / determined *using SoftGather*.

    Statistical significance was analyzed by using / through the use of *SoftGather.*

    We used commercially available software / a commercially available software package.

    Free software, downloaded from www.free.edu, was used / adopted *to …*

21. Reporting customizations performed

    X was tailored / customized *for use with* …

    X can easily be customized / adapted / modified *to suit all requirements*.

    Measurements were taken using purpose-built / custom-built / customized *equipment*.

    The apparatus was adapted as in [Ref] / in accordance with [Ref] / as follows:

    The following changes / modifications *were made:*

    The resulting ad hoc device can / is able to / has the capacity to …

22. Formulating equations, theories and theorems

    This problem can be outlined / phrased / posed *in terms of …*

    The problem is ruled by / governed by / related to / correlated to …

    This theorem asserts / states *that* …

    The resulting integrals / solution to X *can be expressed as* …

    … *where T* stands for / denotes / identifies / is an abbreviation for *time*.

    By substituting / Substituting / Substitution *into* …

    Combining / Integrating / Eliminating .. *we have that:* …

    Taking advantage of / Exploiting / Making use of *X, we …*

    On combining this result with X, we deduce / conclude *that* …

Subtracting X from Y, we have that / obtain / get …

Equation 1 shows / reveals *that*

This gives the formal solution / allows a formal solution to be found …

It may easily / simply *verified that* …

It is straightforward / easy / trivial *to verify that* …

For the sake of simplicity / reasons of space*, we*

23. Explaining why you chose your specific method, model, equipment, sample etc.

    The aim / purpose *of X is to do Y.* Consequently we / As a result we / Therefore we / We thus …

    This method / model / system *was chosen because it is one of the most* practical / feasible / economic / rapid *ways to …*

    We chose this particular apparatus because / on account of the fact that / due to / since …

    It was decided that the best procedure / method / equipment *for this* investigation / study *was to …*

    An X approach was chosen / selected *in order to …*

    The design of the X was based on / is geared towards …

    We opted for / chose *a small sample size* because / due to / on the basis of …

    By having / By exploiting / Through the use of *X, we were able to …*

    Having an X enabled us to / allowed us to / meant that we could *do Y*.

24. Explaining the preparation of samples, solutions etc.

    We used reliable / innovative / classic / traditional *techniques based on the recommendations of …*

    Xs were prepared as described by / according to / following *Jude [2010*].

    Xs were prepared in accordance with / in compliance with / as required by….

    Y was prepared using the same / a similar *procedure as for X.*

    All samples were carefully / thoroughly *checked for …*

    X was gradually / slowly / rapidly / gently *heated*

    The final / resulting *solutions contained …*

    This was done by means of / using / with *a calculator*.

25. Outlining selection procedure for samples, surveys etc.

    The traditional / classical / normal / usual *approach to sample collection is to* …

    The criteria / reasons *for selecting Xs were*:

    The sample was selected / subdivided *on the basis of X and Y*.

    The initial sample consisted of / was made up / was composed of …

    Approximately / Just over / Slightly under *a* half / third / quarter *of the sample were* …

    A total of 1234 Xs were recruited for this study / this survey / for interviews.

    At the beginning of the study, all of the participants / subjects / patients *were aged* ……

    In all cases patients' / subjects' / participants' *consent was obtained*.

    Interviews were performed / conducted / carried out *informally*

    The interviewees were divided / split / broken down *into two groups* based on / on the basis of …

26. Indicating the time frame (past tenses)

    Initial studies were made / performed / done / carried out / executed *using the conditions described above* over / for *a period of …*

X was collected / used / tested / characterized / assessed *during the* first / initial *step*.

Prior to / Before doing *X, we did Y*.

First we estimated / determined *the value of X*, then / subsequently *we* studied / analyzed / evaluated *Y*.

Once / As soon as / After X *had been done, we then did Y*.

The levels were thus / consequently / therefore *set at …*

After / Afterwards / Following this, *X was subjected to Y.*

The resulting / remaining *Xs were then …*

The experiment was then repeated / replicated *under conditions in which …*

Finally, independent / separate / further / additional *tests were performed on the …*

27. Indicating the time frame in a general process (present tenses)

In the first step / During the first phase / In the initial stage *of the process …*

Once / As soon as / After *X has been done, we can then do Y.*

This sets the stage / We are now ready *for the next step.*

At this point / Now *X can be …*

After / When / As soon as *these steps have been carried out, X …*

With the completion of these steps / When these steps have been completed, *we are now ready to …*

This condition cannot be reached until / unless *X has been …*

When / As soon as *X is ready, the final adjustments can be made*.

The completed X can now / then / subsequently *be used to …*

By reducing the amount of X / If the amount of X is reduced, *Y can then be done.*

To reduce the risk of Y, place / The risk of X can be reduced by placing *all the Xs in a container.*

The experiment proceeds / continues *following the steps outlined below*.

28. Indicating that care must be taken

To do this entails / involves / requires *doing X.*

It is seldom / rarely / usually / generally / often / always *practical to …*

Considerable / Great *care are must be* taken / exercised *when …*

A great deal of / Considerable *attention must be paid when …*

Extreme caution must be taken / used *when …*

29. Describing benefits of your method, equipment etc.

This method represents a viable / valuable / useful / groundbreaking / innovative *alternative to …*

This equipment has the ability / capacity / potential *to outperform all previous Xs.*

This apparatus has several / many *interesting* features / characteristics.

Our method has many interesting / attractive / beneficial / useful / practical / effective / valuable *applications*.

Of particular / major / fundamental *interest is …*

The key / basic / chief / crucial / decisive / essential / fundamental / important / main / major / principal *advantages are*:

Our procedure is a clear improvement / advance *on current methods*.

We believe this solution will aid / assist *researchers to …*

This solution improves on / enhances / furthers / advances *previous methods by …*

The benefits / advantages *in terms of X far outweigh the disadvantages with regard to Y.*

30. Outlining alternative approaches

A less lengthy / time-consuming / cumbersome / costly *approach is …*

A neater / more elegant / simplified / more practical *solution for this problem …*

An alternative solution, though with high overheads / slightly more complicated / less exhaustive *is …*

One / One possible / A good way *to avoid the use of X is to use Y instead.*

31. Explaining how you got your results

To assess X / evaluate X / distinguish between X and Y, *Z was used.*

X analysis was used to test / predict / confirm *Y.*

Changes in X were identified / calculated / compared *using …*

The correlation / difference *between X and Y was tested.*

The first set of analyses investigated / examined / confirmed / highlighted *the impact of …*

32. Reporting results from questionnaires and interviews

Of the study population / initial sample / initial cohort, *90 subjects completed and returned the questionnaire.*

The response rate was 70% at / after / for the first *six months and …*

The majority of respondents / those who responded *felt that ….*

Over half / Sixty per cent *of those* surveyed / questioned *reported that …*

Almost / Just under / Approximately *two-thirds of the participants (64%)* said / felt / commented *that …*

Only / Just a small number / Fifteen per cent *of those interviewed* reported / suggested / indicated *that …*

Of the 82 subjects who completed the questionnaire / took part in the survey / agreed to participate, *just* under / over *half replied that ….*

A small minority of / Hardly any / Very few participants *(4%) indicated …*

In response to Question 1, most / nearly all / the majority *of those surveyed indicated that …*

When the subjects were asked about / questioned on *X the majority commented that ….*

The overall response to this question was surprisingly / unexpectedly / very / quite *negative*.

33. Stating what you found

These tests revealed / showed / highlighted *that …*

Strong / Some / No evidence *of X was found …*

Interestingly / Surprisingly / Unexpectedly, *for high values of X, Y was found ..*

There was a significant positive / no *correlation between …*

On average / Generally speaking / Broadly speaking, *we found values for X of …*

The average / mean *score for X was …*

This result is significant only / exclusively *at an X level.*

Further analysis / analyses / tests / examinations / replications *showed that …*

34. Stating what you did not find

No significant difference / correlation *was* found / identified / revealed / detected / observed / highlighted between ….

There were no significant differences between X and Y in terms of Z / with regard to Z / as far as Z is concerned.

The analysis did not show / reveal / identify / confirm *any significant differences between …*

None of these differences were / Not one of these differences was *statistically significant*.

Overall / Taken as a whole / Generally speaking / With a few exceptions, *our results show X did not affect Y*.

35. Highlighting significant results and achievements

The most striking / remarkable *result to emerge from the data is that …*

Interestingly / Curiously / Remarkably / Inexplicably, *this correlation is related to ….*

Significantly / Importantly / Crucially / Critically, *X is …*

The correlation between X and Y is interesting / of interest / worth noting / noteworthy / worth mentioning *because …*

The most surprising / remarkable / intriguing *correlation is with the …*

The single most striking / conspicuous / marked *observation to emerge from the data comparison was …*

It is interesting / critical / crucial / important / fundamental *to note that …*

We believe that / As far as we know / As far as we aware *this is the first time that X …*

We believe that / We are of the opinion that / In our view *the result emphasizes the validity of our model.*

This result has further strengthened our confidence in X / conviction that X is / hypothesis that X is …

Our technique shows a clear / clearly has an *advantage over …*

The importance of X cannot be stressed / emphasized *too much.*

This underlines / highlights / stresses / proves / demonstrates *just how important X is.*

The utility of X is thus underlined / highlighted / stressed / proved / demonstrated.

This finding confirms / points to / highlights / reinforces / validates *the usefulness of X as a …*

Our study provides additional support for / further evidence for / considerable insight into *X.*

These results extend / further / widen *our knowledge of X.*

These results offer compelling / indisputable / crucial / overwhelming / powerful / invaluable / unprecedented / unique / vital *evidence for …*

36. Stating that your results confirm previous evidence

Our experiments confirm / corroborate / are in line with / are consistent with *previous results [Wiley 2009].*

The values are barely / scarcely / hardly *distinguishable from [Li 2010] who …*

This value has been found to be / is *typical of X.*

This is in good agreement / in complete agreement / consistent *with …*

This fits / matches / concurs well with [*65] and also confirms our* earlier / previous *findings [39, 40, 41].*

This confirms / supports / lends support to / substantiates *previous findings in the literature …*

These values correlate favorably / satisfactorily / fairly well *with Svenson [2009] and further support the* idea / role / concept *of …*

Further tests carried out with X confirmed / corroborated / concurred with *our initial findings*.

As proposed / suggested / reported / indicated / put forward *by Dong [2011], the evidence we found points to …*

Our results share / have *a number of similarities with Claire et al.'s [2012] findings …*

37. Stating that your results are in contrast with previous evidence

It was found that X = 2, whereas / on the other hand *Kamatchi [2011] found that …*

We found much higher values for X than / with respect to *those reported by Pandey [2000].*

Although / Despite the fact that *Li and Mithran [2014] found that X = 2 we found that X = 3.*

In contrast to / contradiction with *earlier findings [Castenas, 2009], we …*

This study has not confirmed previous research on X. However / Nevertheless / Despite this, *it serves to …*

Even though these results differ from some published / previous / earlier *studies (Cossu, 2001; Triana, 2002), they are consistent with those of …*

Kosov et al. noted that x = y. Our results do not support / appear to corroborate / seem to confirm *their observation, in fact …*

Georgiev is correct to argue / propose / claim *that x = y. However, his calculation only referred to the limited case of …. and our conclusion of x = z, would thus seem to be* justified / justifiable / defensible / correct / acceptable / warranted.

Although our results differ slightly / to some extent / considerably *from those of Minhaz [2001], Erturk [2007], and Hayk [2014], it* can / could *nevertheless be argued that …*

Our findings do / The current study does *not support previous research in this area. In fact,* contrary to / unlike / in contrast with *what was previously thought, we found that …*

These findings refute / disprove / are in contradiction with / contrast with / significantly differ from *previous results reported in the literature*.

38. Stating and justifying the acceptability of your results

As expected / anticipated / predicted / forecast / hypothesized, *our experiments* show / demonstrate / prove *that …*

Our formula captures / reproduces *the response of …*

Apart from this slight discordance / discrepancy / disagreement / non-alignment, *the result is confirmation of …*

Despite / Notwithstanding *the lack of agreement, we believe our findings compare well with …*

Although / Even though / Despite the fact that *there was some inconsistency …*

There is satisfactory / good / exceptional / perfect *agreement between …*

No significant / substantial / appreciable / noteworthy *differences were found …*

Our findings appear to be well substantiated / supported *by …*

The number of Xs that confirmed our findings was appreciable / significant / substantial.

39. Expressing caution regarding the interpretation of results

Initially we thought that x was equal to y. However, a more careful analysis / closer inspection *revealed that …*

These results / data / findings *thus need to be interpreted with* caution / care / attention.

The conclusions of the review should be treated / interpreted / analyzed / read *with caution*.

However, due care / careful attention / extreme caution *must be* exercised / paid *in …*

Given that our findings are based on a limited number of Xs, the results from such analyses should thus / consequently / therefore *be treated with* considerable / the utmost *caution*.

Other researchers have sounded / We should sound *a note of caution with regard to such findings.*

40. Outlining undesired or unexpected results

    As was / might have been *expected, our findings were often contradictory …*

    Contrary to expectations / Unlike other research carried out in this area, *we did not find a significant difference between …*

    Our results were disappointing / poor / inadequate / unsatisfactory / below expectations. *However, …*

    Our study was unsuccessful / not successful *in proving that …*

    Our research failed to account for / justify / explain / give an explanation for / give a reason for *the low values of …*

    Surprisingly / Unfortunately / Disappointingly / Regrettably, *no* signs of X were / evidence for X was *found.*

    What is surprising / we were surprised to find / we are unable to account for *is the fact that …*

    A substantial / appreciable / noticeable *disagreement is evident.*

    The Xs appear to be over-predicted / overestimated / overstated …

    This number is slightly lower than the value we expected / anticipated / predicted *and there is certainly room for improvement.*

41. Admitting limitations

    We aware that our research may have two limitations. The first is … The second is … These limitations highlight / reveal / underline / are evidence of *the difficulty of collecting data on ….*

    It is plausible that a number of limitations may / might / could have *influenced the results obtained.* First / To begin with … An additional / Another *possible source of error is …*

    Since / Given that / As *the focus of the study was on X …* there is a possibility / there is some likelihood / it is not inconceivable *that dissimilar evaluations would have arisen if the focus had been on Y.*

    The restricted use of X could account for / be the reason for / explain why …

    There are several sources for / causes of / reasons for *possible error.*

    A major source of unreliability / uncertainty / contamination *is in the method used to …*

    Unfortunately, it was not possible / we were unable *to investigate the significant relationships of X and Y further* because / due to the fact that *Z is …*

    Inevitably / Not surprisingly / As expected / As anticipated, *there were some* discrepancies / inaccuracies / problems *due to …*

    The performance was rather / slightly / a little *disappointing. This was probably as a result of …*

    One downside / disadvantage / negative factor *regarding our methodology is that …*

    Further data collection is required / would be needed *to determine exactly how X affects Y.*

42. Explaining and justifying undesired or unexpected results

    It is very likely / probable / possible *that participants may have erroneously … and this may have* led to / brought about *changes in …*

    The prime / primary / foremost *cause of the discrepancy is* due to / a result of / a consequence of *X.*

    This apparent lack of correlation can be attributed to / explained by / justified by …

    The reason for this rather contradictory result is still not entirely / completely *clear, but …*

    There are several possible explanations for this result / finding / outcome.

    These differences can be explained / justified / accounted for *in part by …*

    It can thus be suggested / conceivably hypothesized / reasonably assumed *that …*

The unexpectedly high / low *level of X is* undoubtedly / certainly / without any doubt *due to …*

A possible / reasonable / satisfactory *explanation for X may be that ….*

Another possible explanation / rationalization / reason *for this is that …*

Clearly / Evidently / Naturally *there may be other possible explanations.*

This happened / occurred / may have happened / may have occurred *because we had not examined X* sufficiently / in enough depth *due to …*

The reasons for this result are not yet wholly / completely / entirely *understood.*

It cannot be ruled out / ignored *that there was some unintended bias in …*

An unintended bias cannot be ruled out / should be taken into consideration.

We cannot rule out that X might / may have influenced Y.

The observed increase in X *could* be attributed to / might be explained by it / could be interpreted as *being a result of …*

Despite the fact that / Although *X was expected to do Y, it was not predicted that X would also do Z. However, this is not particularly surprising* given the fact / in light of the fact / if we consider *that …*

43. Minimizing undesired or unexpected results

Although performance was not ideal / perfect / optimal, *we* still / nevertheless *believe that …*

This poor performance was not unexpected / surprising / very significant. *In fact …*

This result was not *expected / predicted / anticipated*. However, *the reason for this is probably / it is likely that the reason for this is / it is probable that the reason for this is* that …

Our investigations so far have only been on a small scale / applied to …

These discrepancies are negligible / can be neglected / considered as insignificant / are of no real consequence *due to the fact that …*

Despite the limitations of this method, and consequently the poor results in Test 2, our findings do nevertheless / in any case / however *suggest that …*

Given that / Since / On account of the fact that *this was only a preliminary attempt to do X it is hardly surprising that …*

As is well known, Xs are extremely hard / difficult / problematic / time-consuming / cumbersome *to control,* so / thus / consequently ….

In fact, X was beyond the scope of this study / not a primary goal in this research / not the focus of this study / not attempted in this study.

Consequently, it is inevitable / understandable / not hard to appreciate / not surprising that …

Note / It should be noted / It is worthwhile noting *that …*

A / One *limitation of our research is that the surveys were not conducted in the same period.* However / Nevertheless / Despite this, *we can still state that …*

We failed / were not able / were unable *to find a link between x and y, but this* may / might *depend on the methodology chosen for our research.*

44. Expressing opinions and probabilities

To the best of our knowledge / As far as we know / We believe that *no other authors have found that x = y.*

It would seem / appear *that …*

Our findings would seem to show / demonstrate / suggest / imply *that x = y.*

This factor may be responsible / is probably responsible / could well be responsible *for this result.*

Presumably / We hypothesize / I argue *that this factor is …*

We believe that our method could be used / probably be usefully employed *in…*

Our approach *would lend itself well for use by / may be useful for …*

In our opinion / view, *this method could be used in …*

We believe / feel strongly *that …*

There is evidence to suggest / support *the hypothesis that …*

It is proposed / This may mean / It seems likely / It may be assumed *that …*

This implies / suggests / would appear to indicate *that …*

The results point to the likelihood / probability *that …*

There is a strong / definite / clear / good *probability that …*

45. Announcing your conclusions and summarizing content

    In conclusion / In summary / In sum / To sum up, *our work …*

    Our work has led us to conclude / the conclusion *that …*

    We have *presented / outlined / described …*

    In this *paper / study / review* we have …

    This paper has *investigated / explained / given an account of …*

46. Restating the results (Conclusions section)

    The evidence from this study suggests / implies / points towards the idea / intimates *that …*

    The results / findings *of this study* indicate / support the idea / suggest *that …*

    In general, / Taken together, *these results* suggest / would seem to suggest *that …*

    An implication / A consequence / The upshot *of this is the possibility that …*

47. Highlighting achievements (Conclusions section)

    Our research / This paper *has* highlighted / stressed / underlined *the importance of …*

    We have managed to do / succeeded in doing / been able to do / found a way to do *X.*

    We have found an innovative / a new / a novel / a cutting-edge *solution for …*

    We have obtained accurate / satisfactory / comprehensive *results* proving / demonstrating / showing *that …*

    We have devised a methodology / procedure / strategy *which …*

    We have confirmed / provided further evidence / demonstrated *that …*

    Considerable progress has been made / insight has been gained *with regard to …*

    Taken together, these findings suggest / implicate / highlight *a role for X*

    Our study provides the framework / a springboard / the backbone / the basis / a blueprint / an agenda / a stimulus / encouragement *for a new way to do X.*

    The strength / strong point / value / impact / benefit / usefulness / significance / importance *of our* work / study / contribution *lies in …*

    X provides a powerful tool / methodology *for …*

    X ensures / guarantees *that X will do Y, and it can be generalized to …*

    Our investigations into this area are still ongoing / in progress *and seem likely to confirm our hypothesis.*

    These findings add to a growing body of literature on / substantially to our understanding of *X.*

48. Highlighting limitations (Conclusions section)

    Our work clearly has some limitations. Nevertheless / Despite this *we believe our work could be* the basis / a framework / a starting point / a springboard for

Despite the fact that there are / In spite of the fact that / Although *there are limitations due to Y, we …*

The most important limitation lies in / is due to / is a result of *the fact that …*

The current study was limited by / unable to / not specifically designed to…

The present study has only investigated / examined *X*. Therefore / Consequently …

The project / analysis / testing / sampling *was limited in several ways. First, …*

Finally, a number of potential limitations / weaknesses / shortfalls / shortcomings / weak points *need to be considered. First, …*

However, given the small sample size, caution must be exercised / taken / used / applied.

The findings might not be *transferable to / generalized to / representative of …*

The picture / situation *is thus still incomplete*.

49. Outlining possible applications and implications of your work

This study is the first step / has gone some way *towards enhancing our understanding of …*

These observations have several / three main / many implications *for research into …*

This work has revealed / shown / highlighted / demonstrated / proved *that …*

The present findings might help to solve / have important implications for solving / suggest several courses of action in order to solve *this problem*.

X is suitable for / has the potential to …

Our method / technique / approach / procedure *could be applied to …*

One possible / potential / promising *application of our technique would be …*

Results so far have been very promising / encouraging *and …*

This approach has the potential / requirements / characteristics / features *to …*

This could eventually / conceivably / potentially / hypothetically *lead to …*

Our data suggest that X could be used / exploited / taken advantage of / made use of *in order to …*

In our view these results are / constitute / represent *an excellent initial step toward …*

We believe / are confident *that our results may improve knowledge about …*

These early successes may hope to resolve / tackle / solve / deal with …

Another / An additional / A further important *implication is …*

Our research could help / be a useful aid for / possibly support *decision makers because …*

We think that our findings could / might *be useful for …*

We hope that our research will be helpful / useful / beneficial / constructive / valuable *in solving the difficulty of …* At the same time / In addition / Further / Furthermore *we believe that …*

Our research suggests that the policy makers should encourage / it is important for policy makers to encourage *stakeholders to …*

The findings of my research have serious / considerable / important *managerial implications*.

50. Future work already underway or planned by the authors

We are currently / now / in the process *of investigating …*

Research into solving this problem is already underway / in progress.

To further our research we plan / are planning / intend *to …*

Future work will concentrate on / focus on / explore / investigate / look into …

Further studies, which take X into account, will need to be undertaken / performed.

We hope that further tests will prove our theory / confirm our findings.

These topics are reserved for / deferred to *future work.*

51. Future work proposed for third parties to carry out

Further work needs to be done / carried out / performed *to establish whether …*

Further experimental investigations / tests / studies *are needed to estimate …*

More / Additional / Further *work on X, would help us to do Y.*

We hope / believe / are confident *that our research will serve as a base for future studies on …*

It is recommended / We recommend / We suggest / We propose *that further research should be undertaken in the following areas:*

More broadly / On a wider level, *research is also needed to determine ….*

This research has raised / given rise to / thrown up *many questions in need of further* investigation / study / examination.

This is an important / a fundamental / a vital issue *for future research.*

The design and development of Xs will challenge / be a challenge for *us for years.*

Future work should concentrate / focus *on enhancing the quality of X.*

Future studies should target / aim at / examine / deal with / address *X.*

Future studies on the current topic are therefore required / needed / recommended / suggested *in order to* establish / verify / validate / elucidate …

Our results are encouraging / promising *and should be validated by a larger sample size.*

These findings suggest the following directions / opportunities *for future research: ….*

An important issue / matter / question / problem *to resolve for future studies is …*

The prospect of being able to do X, serves as a continuous incentive for / stimulus for / impulse for / spur *to future research.*

52. Acknowledgements

This work was carried out / performed *within the framework of an EU project and was partly sponsored by …*

This research was made possible by / benefited from *a grant from …*

Support was given by the Institute of X, who funded the work in all its / its initial *stages.*

We thank / would like to thank *the following people for their support, without whose help this work would never have been possible:*

We gratefully acknowledge the help provided by Dr. X / constructive comments of the anonymous referees.

We are indebted / particularly grateful *to Dr. Alvarez for …*

We thank / are grateful to / gratefully acknowledge *Dr. Y for her* help / valuable suggestions and discussions.

Thanks are also due to / The authors wish to thank *Prof. X, who gave us much valuable advice in the early stages of this work.*

Dr. Y collaborated with / worked alongside *our staff during this research project.*

We also thank Prof. Lim for her ongoing collaboration with our department / technical assistance in all our experimental work.

53. Referring to tables and figures, and to their implications

Table 1 compares / lists / details / summarizes *the data on X.*

Table 2 proves / shows / demonstrates / illustrates / highlights *that X is …*

Figure 1 presents / reports / shows / details *the data on X.*

Figure 3 pinpoints / indicates *exactly where X meets Y.*

As shown / highlighted / illustrated / detailed / can be seen *in Fig. 1, the value of …*

The value of X is greater when Y = 2 (Fig. 1 / Eq. 2)

The results on X can be seen / are compared / are presented *in Fig. 1.*

From the graph / photo / chart / histogram *we can* see / note *that …*

It can be seen in / is apparent from *Fig. 1 that …*

We observe / note *from Table 1 that ..*

The graph above / below / to the left / to the right *shows that …*

Figure 8 shows a clear trend / significant difference *in …*

The table is revealing / interesting *in several ways. First …*

54. Making transitions, focusing on a new topic

    If we now turn to / Turning now to / Let us know look *at the second part …*

    As far as *X is / Xs* are concerned …

    As regards / Regarding / Regarding the use of / As for *X, it was found that …*

55. Referring backwards and forwards in the paper

    As was mentioned / stated / noted / discussed / reported *in the Methods, …*

    As reported above / previously / earlier / before …

    As mentioned / stated / outlined *in the literature review …*

    The above- / afore-mentioned *X is …*

    More details on this will be given below / in the next section / in the appendix.

    The following is / Here follows / Below is *a list of …*

    Please refer to Appendix 2 / Table 6 / the Supplementary Material *for….*

56. Referring back to your research aim

    As stated in the Introduction, our main aim / objective / target / purpose / goal *was to …*

    As stated in the Introduction, the research was conducted / undertaken / carried out *in order to …*

    Given that / Since *our main aim was, as mentioned in the Introduction, to …*

    Before interpreting our results, we remind the reader of / would just like to restate *our main aims.*

    Returning to the hypothesis / question *posed at the beginning of this study, it is now possible to state that …*

57. Referring outside the paper

    See the respective handbook [Ref] for a description of X.

    For a detailed review on this topic see [Ref].

    More details on this topic can be found in [Ref].

Chapter 20
The Final Check

Why is this chapter important?

Many researchers finish their manuscripts just before (and often after!) the deadline. Due to such pressures of time, they often send their manuscript to the editor without doing a final check. Most manuscripts are written by multiple authors. This involves a lot of exchanges of versions of the manuscripts, with a consequent increase in the possibility of mistakes being introduced. Lots of changes are made at the last minute, and often no one checks them for accuracy in terms of English. One author needs to be responsible for the final check.

This chapter covers the kinds of things you should look for when doing this final check. The result is that you will increase the chances of your paper being accepted.

Referees are famous for asking for revisions before acceptance, which often involve what you might consider as trivial details, such as typos and spelling mistakes. Such delays cost you time and money and may also mean that another paper on the same topic gets published before yours.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_20,

What the experts say

The maxim "Good Writing is Re-Writing" is fundamental to producing a well written paper. Having a good first draft is the starting point for really crafting the logic, structure, and flow of your writing. Rewriting can also be the most fun, intellectually engaging, and satisfying part of the writing process.

Professor Ken Lertzman, School of Resource & Environmental Management, Simon Fraser University, Vancouver, Canada

It's always a good idea to get someone else read through what you have written (for typos, clarity of expression etc.). In my experience, editing other people's work in an objective way is far easier than editing your own stuff!

Mark Worden, editor Speak Up, and author

Having your manuscript revised by a professional editing service prior to journal submission will greatly improve the quality of its English – both the grammar and also the readability. Additionally, if the editor has experience as a researcher and is familiar with your discipline, then minor technical errors can also be corrected at this stage. Overall, your work will then create a much better impression with the journal referees, thus reducing the number of their criticisms and misunderstandings, and increasing the chances of its acceptance for publication.

Alexander (Sandy) Lang, founder / director of Rescript, a professional editing service

20.1 Ensure your paper is as good as it could possibly be the first time you submit it

On the excellent pages on the website of the University of Canberra (see link on page 313 (16.8)), Professor Ken Lertzman makes the following comment:

> It takes much longer to read poor writing than good writing. It is a waste of an advisor's or editor's time to read material that is not yet ready to be presented - and it is disrespectful to expect them to do so.

Researchers tend to leave the manuscript writing process to the very last minute. This often results in a poorly written paper. Unfortunately, poor English and lack of clarity are one of the most frequent causes of a paper being initially rejected. You will waste several months if you have to resubmit your paper, and in the meantime someone else might publish a paper on the exact same topic!

Ideally, you should get a colleague to read through you manuscript to check for points 20.7–20.19 below.

20.2 Print out your paper. Don't just correct it directly on your computer

It is good practice to print out your paper. You are more likely to find mistakes connected with grammar, word order, and structure. Convert your document into a font that you find easy to read (e.g. Arial) and use 'double space' line spacing.

On screen you have much less perception of how your paper will look visually, and may not even notice that a paragraph is more than a page long. In a printed version, such long paragraphs are instantly visible. You thus have the opportunity to break them up into shorter paragraphs that are easier on the eye. Breaking up paragraphs is quick and easy to do (Sect. 4.13).

Also, ask a colleague to read your printed version. He or she will very likely find mistakes that you have overlooked - in fact, your familiarity with your own work makes it quite difficult to spot errors.

Finally, read your manuscript aloud. You will find mistakes that are hard to find by reading silently – particularly with regard to how a sentence flows and whether there are words missing.

20.3 Always have the referee in mind

The key factor when revising your paper is to have the referee in mind. Here are two quite typical comments related to poor writing skills.

> I often had to defer my interpretation of the meaning of a sentence until I had read it in its entirety. Frequently I got lost in a series of subordinate clauses. The paper would thus benefit from a major revision from a language point of view.
>
> This paper could be improved considerably if the authors gave more consideration to their readers. At times it was difficult to follow the logical connection of the authors' ideas, and on several occasions I was tempted to stop reading completely.

Referees often make a direct connection between the time and effort that an author makes in presenting information, and how much time and effort the author has spent in doing their research. If the information is presented badly, then the implication is that the research may have been conducted badly too. Also it helps to remember that referees make reports on manuscripts in their free time for no financial reward – they are of much more benefit to you, than you are to them!

20.4 Anticipate referees' comments on your English

Dr Robert Coates, author of the paper 'Language and publication in Cardiovascular Research articles', has found that "badly written articles" correlate with "a high rejection rate".

> Many factors could influence the rejection of an article. However, we found clear indications that carelessly written articles could often have either a direct or subliminal influence on whether a paper was accepted or rejected. On equal scientific merit, a badly written article will have less chance of being accepted. This is even if the editor involved in rejecting a paper does not necessarily identify language problems as a motive for rejection.

His research refers to papers that were submitted for publication in Cardiovascular Research – see page 314 for a link to his very revealing article. He also found that manuscripts that had the lowest acceptance rate also had the highest error rate in terms of English.

This does not mean that all papers with high error rates were rejected, or that low acceptance rate was determined exclusively by poor English. But he did find a definite correlation.

Referees are generally not English language experts. They are interested much more in the scientific content than in the level of English. The comments that referees make on your English often depend on whether they are native speakers (NS) or non-native speakers (NNS).

NNS referees tend to recognize the elements of 'poor' English that for them stand out the clearest:

- spelling mistakes and typos
- simple grammar mistakes (e.g. missing *s* on plurals and third person)

Here is a typical example, written by an NNS referee commenting on an NNS's English:

> A big problem with this work is the English form: there are so many language errors that it actually seriously compromises one's ability to understand what is being presented. The paper needs an extensive revision by a native English speaker.

NS referees, on the other hand, tend to focus more on problems related to intelligibility and readability: verbosity, redundancy and rambling sentences. Many native English-speaking referees are sympathetic to their non-native colleagues. One reviewer I contacted said:

> I typically don't comment on minor grammatical issues in my reviews unless the grammar makes the content hard to follow or understand. I can't imagine having to write all my scientific papers in a second language—it's hard enough to do in a native language—so I have a lot of sympathy for people who have that obstacle to publication.

Grammatical and lexical errors are unlikely to completely impair a referee's understanding of your paper, but too many of them might cause referees to become irritated and to lose interest not only in what you are writing about, but in you as well. Basically if your paper is filled with errors this requires too much effort on the part of the referee and this may have a negative impact on his / her opinion not only of your paper but also on your credibility as a reliable researcher.

All referees object to spelling mistakes, particularly as this is something that authors can easily check themselves. A series of trivial and easily correctable mistakes, may make some referees feel that you are not very competent and reliable - and their opinion of your English may even throw doubts on their opinion of how well you carried out your research.

Judging errors is an extremely subjective exercise, and different referees may have very different ideas about what they would term as 'intolerable' or 'objectionable' errors. This may help to explain those occasions when your paper is rejected by one referee for 'very poor' English, whereas the other referees make no comment at all about the English level.

Sometimes referees will give no specific reasons for rejecting your paper due its poor English, but they will say something like: This referee recommends that the authors have their paper revised by a qualified native English speaker. This may happen for two reasons:

1. the referee is either a NS or a NNS and feels that the quality of the English is low but is unable to pinpoint exactly what it is. In this case, the cause of the problem is generally an overall lack of readability.
2. the referee is a NNS, is not sure of the level of English, and wants to protect himself / herself just in case there are errors. This is a face-saving device adopted by NNS referees in relation to the editor. However, please note that this only happens in some cases, and is not a general rule.

With regard to the second point, I once revised a paper for a client and I highlighted three terms that were unfamiliar to me and which I recommended the author should change. For some reason the author did not make these particular changes and his manuscript was initially rejected. Of course the rejection was primarily for scientific reasons and not problems with the English (I had, after all, revised the English and apart from the words and phrases I had highlighted, the English was perfect). However, all three referees spotted the unfamiliar terms which included one word that was archaic (i.e. a word that is no longer used) and two terms that the author had clearly invented himself. Purely on the basis of these three vocabulary items, two of the referees recommended that the paper be revised by a professional mother tongue editor before being accepted for publication - despite the fact that the paper was actually in near perfect English.

How is this possible? The two referees were in fact both NNSs - I could recognize this from the English of their reports which contained some errors. What they saw was three clear errors of English. Their feeling was probably "If I have recognized these three errors, there may be many others too that I may not be able to spot. To protect myself, and the author, I think I should recommend a revision by a professional".

Having to submit your manuscript to a professional not only has a monetary cost, but also causes further delay to your paper being published. Consequently:

1. it is generally wise to take into account the comments made by professional proofreaders - if you don't agree with your proofreader's recommendations, then contact him/her again for clarifications
2. you should make sure that the words you use are in current use. The fact that your spell checker does not underline it in red, or that you found the word in a reputable dictionary, does not mean that is acceptable to use
3. you should never invent terms, even if the term you invent is made up of words that actually exist and are commonly used. For example, although you can say 'bankruptcy law', 'employment law' and 'immigration law', you cannot by analogy (i.e. noun + *law*) invent the term 'nature law' or 'population initiative law' even though similar terms may exist in your own language

You can easily check for points 2 and 3 by searching on Google Scholar and ensuring that the returns are from native speakers.

20.5 Judge your writing in English in the same way as you would judge it if you had written the paper in your native language

What you write has to make sense. In my job as an editor and proofreader of research papers, I read a lot of sentences, sometimes even whole paragraphs, that appear to make no sense. The problem is particularly acute in the more humanistic

sciences, where the author is expressing ideas and theories, rather than drawing conclusions from hard data.

For me the reason why such sentences make no sense is due to one or more of the following:

1. The author is not really interested in conveying his (for the sake of simplicity, I will imagine that the author in question is a man) meaning to the readers.
2. The sentence would have made little or no sense even in the original language. The author hoped that in some miraculous way it would make more sense in English.
3. The author had an idea in his head. This idea appeared to make sense in his own language. He translated it into English. He looked at the result, which appeared to him to match what he was trying to say. In addition, it sounded good in English. But he did not have the critical faculties to decide whether the sentence, in its English version, really did make sense. It is as if English filters out the author's good judgment. It seems to allow the author to distance himself from what he writes. In fact, reading a sentence that you have written in your own language is a different experience from reading a sentence that you have written in a foreign language. When you are writing in your own language you are perhaps more critical of yourself and you are much more aware of how your peers will perceive what you have written.

20.6 Cut, cut, cut and keep cutting

Imagine that you have been asked by the referee to reduce your paper by 25%. As you go through the paper, cut as much as you can (without necessarily eliminating any content). This very rarely leads to a poorer manuscript, more often it improves it massively. On the basis of identical content, there is no referee in the world who would prefer to review a paper of twenty pages rather than fifteen.

Make sure you haven't included any sentences or paragraphs just because they sound good to you or you are particularly pleased with the way you have expressed yourself. For example, in this chapter I could have removed the subsection above (Sect. 20.5), but I decided to include it as an example of something that could be cut!

I could also have cut the quotation below by Joseph Addison (1672–1719), English essayist, poet and politician:

> The English delight in silence more than any other European nation, if the remarks which are made on us by foreigners are true. ... To favour our natural taciturnity, when we are obliged to utter our thoughts, we do it in the shortest way we are able.

Being an Englishman myself I love this quotation, though I am not sure how relevant it is for the purposes of this book!

Finally, a few months into the future you will not even remember what you cut. It may seem desperately important for you to include something now, but really ask yourself: Do my readers need to read this? Will they notice if I have cut it out?

20.7 Check your paper for readability

Website designers follow the principle of 'don't make me think'. This means that everything should be so clear to visitors to their websites, that these visitors intuitively know where to find the information they need. The visitors are not required to think.

Similarly, writers of technical manuals focus on presenting information in an orderly straightforward fashion that requires minimal intellectual effort on the part of the reader – they want the readers to assimilate the information in a relaxed way, they don't want to make their readers tired and stressed.

Richard Wydick, Professor of Law at the University of California, writes:

> We lawyers do not write plain English. We use eight words to say what could be said in two. We use arcane phrases to express commonplace ideas. Seeking to be precise, we become redundant. Seeking to be cautious, we become verbose. Our sentences twist on, phrase within clause within clause, glazing the eyes and numbing the minds of our readers. The result is a writing style that has, according to one critic, four outstanding characteristics. It is "(1) wordy, (2) unclear, (3) pompous, and (4) dull."

You do not want referees and readers to consider your work wordy, unclear, pompous, or dull, so when you make the final check of you manuscript, ask yourself the following questions:

- are my sentences reasonably short? (sentences longer than 30 words are generally hard to assimilate without having to be read twice)
- are my paragraphs reasonably short?
- have I only written what adds value, have I ensured there is no redundancy?
- have I clearly differentiated my work from the work of others so that the referees can understand what I did in relation to what others have done before me?
- have I highlighted my contribution and the gap it fills so that the referees can judge whether my paper is suitable for my chosen journal?

Readability is also affected by the following factors (these are all covered in Part 1 of this book):

- poor layout: large blocks of text are hard to read, whereas short paragraphs with white space in between them are much easier
- ambiguity and lack of clarity: the reader is not sure how to interpret a phrase
- lack of structure: within a sentence, paragraph or section
- too much abstraction: the reader is not given concrete explanations or examples
- lack of consistency

20.8 Check for clarity in the logical order of your argumentation

In English it is considered good practice to state upfront what will be argued in an article and how. As you re-read your manuscript make sure there is a logical progression of your argument. Don't be influenced by how a paper might be written in your own language. Kateryna Pishchikova, a Doctor of Philosophy in Linguistics, says:

> Russians tend to use long and complicated sentences. They often follow a "detective story" logic according to which the reader has to follow the events or arguments as they unfold and will only learn what the author is trying to say at the end. Overall, complexity, and not clarity, is synonymous with good scientific or specialist writing.

So check that your key findings are not hidden in the middle of sentences or paragraphs.

20.9 Do a 'quality control' on your paper

According to David Dunning, author of the paper on incompetence (Sect. 12.9):

> A full 94% of college professors state that they do 'above average' work, although it is statistically impossible for virtually everybody to be above average.

You too may consider your paper to be above average work, but it is worth checking the coverage (i.e. what referees expect to find) and quality of each section by referring to the final subsection in each of Chaps. 11–18.

If you have time it is a good idea is to get colleagues to review your manuscript (including the title), and you review their work. Often it is much easier to spot mistakes (grammatical, stylistic, structural etc.) in other people's work than in your own. But you can improve your critical skills of your own work if you become accustomed to critically evaluating other people's papers.

20.10 Be careful with cut and pastes

If you write your paper in conjunction with other authors you multiply the chances of mistakes and ambiguity. Words such as *it, that, this, one, former, latter* and *which* are potentially dangerous if the words they refer to are subsequently changed by another author. For example, imagine Author 1 writes

> ... Russia, Canada and the United States. In the former ...

Then, in order to put the countries in alphabetical order, Author 2 modifies it as follows:

> ... Canada, Russia and the United States. In the former ...

The problem is that *the former* in Author 1's sentence refers to Russia. But in Author 2's sentence *the former* refers to Canada. To avoid such mistakes it is always best to repeat the key word rather than using *it, that, this, one, former, latter* and *which.* In any case, if it is your job to read the final version of the manuscript it is worth taking such problems into consideration.

For more on sources of ambiguity see Chap. 6.

20.11 Double check that you have followed the journal's style guide

It is highly irritating for referees and editors when authors submit papers that do not respect the stylistic requirements of the journal. This is particularly true with regard to how you cite the literature both within the body of the paper and in the Literature Cited section.

20.12 Make sure that everything is completely accurate

This avoids referees from having to include in their report lists of small things that need changing. A paper for publication in a journal is very different from a thesis. When you wrote your thesis, you may not have been too worried about being completely accurate in the way you presented references and you may not have proofread it very carefully – "in any case" you thought "no one is ever going to read it". But people will read your manuscript, starting with the referees. If they find that you have cited papers in your introduction but not put them in the bibliography, or vice versa, or if they see spelling mistakes, they might think to themselves: this author has paid little attention to the form of the paper, so there is a strong probability that their research suffers from the same level of unreliability.

20.13 Make sure everything is consistent

Referees will suggest a delay in the publication if they find inconsistency in your paper. Here is a genuine example from a referee's report. The only thing I have changed is the key words (X and Y).

- "Figure 1" on page 4, yet "fig 5a" on page 8.
- page 4: "Figure 1 shows an example of an X graph," yet page 5: Figure 1 caption states "Example of Y". So is it a Y or an X graph?
- commas after some equations like on page 10, but not on all equations.
- caption to Fig 4 states "Initial Size Distribution," yet the illustration is of a graph not a size function.
- sometimes comma after i.e. e.g., and other times not

Here are some extracts from another referee's report, which again highlight the importance of what you may consider to be fairly marginal issues:

> This work is novel and is worthy of publication. However, the presentation of the work is, quite frankly, unprofessional. There are many sloppy mistakes like spelling mistakes and incorrect references, as well as inconsistency such as changing terminology and differences between captions and inline text. Before being accepted for publication the authors need to pay careful attention to the points listed below.

20.14 Dealing with rejections

Most journals reject large numbers of papers. In general, the higher the impact factor of a journal, the higher the risk of rejection. Don't be put off. The highest ranked journals also tend to have the fastest turnaround and may thus return your rejected paper quite quickly. The benefit to you is that you are likely to be given a peer review of an excellent standard, which should help you to revise your paper before submitting it elsewhere. See rejection as an opportunity for making your paper even better.

To give you an idea of how difficult it is to publish a paper in a top ranking journal, here are some statistics from the 'Welcome to resources for authors' page of the website of the British Medical Journal (BMJ), one of the world's most prestigious journals.

> We can publish only about 7% of the 7,000–8,000 articles we receive each year.
> We reject about two thirds of all submissions without sending them for external review.

However there are still advantages of sending your paper to such a journal, even if there is a very high chance of rejection. The BMJ makes very quick decisions (2–3 weeks) so you don't really delay your chances of publishing elsewhere. If they don't even send your paper for external review, it either means your paper is outside the scope of the journal, or that it has some serious flaws in terms of science and/or structure and language. This is a clear indicator that you need to seriously revise your paper. If the BMJ does decide to submit your paper to peer review, the reports you will receive from the reviewers will be very helpful in indicating how your paper can be improved.

20.15 Take editorial comments seriously

There is a tendency to only take into account referees' comments that you agree with and to discount everything else. However, if a referee says that he/she cannot understand what you mean, there is a very good chance that readers will have the same problem.

20.16 Consider using a professional editing service

Consider having your paper corrected through a professional agency or native speaking peer (i.e. someone in the same field as you who has also had papers published). Having your paper revised is certainly a cost, but the cost involved is likely to be far less than 1% of the cost of actually carrying out the research. Yet a good revision will massively increase the chances of your paper being published.

It is wise not to entrust your paper simply into the hands of a local English teacher or the English-speaking husband/wife of a colleague. The fact of speaking or even teaching a language rarely qualifies a person to carry out the difficult task of proof-reading and editing a scientific text.

Some agencies will also give you advice on how to improve your paper in general, and thus act as a pre-refereeing service.

20.17 Don't forget the Acknowledgements

The Acknowledgements generally include one or more of the following.

- Sources of funds.
- People who gave significant technical help (e.g. in the design of your experiment, in providing materials).
- People who gave ideas, suggestions, interpretations etc.
- The anonymous reviewers

It is a good idea to let the people that you wish to acknowledge see the exact wording of how you want to acknowledge them - they might think it is too effusive (or occasionally, insufficient).

The style of giving acknowledgements may be quite different from the style of the rest of the paper. For example, you can use the first person (*I, we*).

Keep your acknowledgements as short as possible, they are generally of little interest to anyone apart from those mentioned.

20.18 Write a good letter / email to accompany your manuscript

If your English is poor in your email, the editor may suspect that the English will be poor in the manuscript too. This is not a good start. To learn how to write effective emails, see the companion volume: English for Academic Correspondence and Socializing.

20.19 Final check: spelling. Don't underestimate the importance of spelling mistakes

I cannot overestimate the importance of doing a final spell check as the <u>very last thing</u> you do before submitting your manuscript.

Poor spelling is considered to be a huge embarrassment in the English-speaking world. Children spend many years learning correct spelling, and adults have been humiliated because of incorrect spelling (remember US Vice President Dan Quayle?). Consequently, rightly or wrongly spelling is a major issue in international journals.

Referees have been known to initially reject a manuscript on the basis of incorrect spelling alone (though I suspect that sometimes this is for political reasons!).

In any case, referees do not like to see spelling mistakes, and some may think that there is an implicit relation between not taking time to check your spelling and possibly not checking your data! Make sure you choose the correct version of English - US or UK - corresponding to your chosen journal. Their style guide for authors should in any case tell you which spelling system they require.

Spelling checkers only pick up words that are not contained in their dictionaries. Mistakes and typos like the ones below would not normally be found because they are words that are in the dictionary (though not with the meaning that the author intended).

> The company was *funded* in 2010. (founded)
> The samples were *weighted* and *founded* to be 100 g. (weighed, found)
> It was different *form* what was expected. (from)

Be careful of: *choose / chose / choice, filed / field / filled, then / than, through / trough, use / sue, with / whit.*
There is a tendency to ignore Word's (and other software's) red underlining of technical words. Just because such words are not in the software's dictionary, does not necessarily mean that you have spelt them correctly.

Spell checkers may not be perfect, but they are very useful. Grammar checkers are also likely to find a few mistakes that you may not have noticed. They will help you find errors connected with subject verb agreement, word order, punctuation (before *which* and *and*, and with hyphenation between words), unnecessary passive forms etc. Obviously the grammar check can only make suggestions, but Word's grammar check found several mistakes in the draft of this book.

20.20 Summary

- Respect the referee. Don't waste his or her time by submitting a poorly written manuscript
- Get a colleague to read through your paper or use a professional editing service
- Print a hard copy of your manuscript. Don't rely on reading it on screen
- Check for all types of mistakes in English: grammar, vocabulary and spelling
- Apply the same standards as if you had written your manuscript in your own mother tongue
- Cut as much as you can
- Check your manuscript for readability and logic
- Be careful with problems cause by multiple authors, e.g. cut and pastes
- Ensure you have followed the journal's style guide, e.g. for citing the literature
- Check for accuracy and consistency
- Take editorial comments seriously
- Remember to acknowledge those that helped you
- As your last task before sending the manuscript to the journal, do a spell check. Don't rely 100% on automatic spell checkers. Spell checkers do not know the difference between *witch* and *which,* or *weighed* and *weighted*

Links and References

Chapter 1

The quotations come from the following books.

page 4 Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book is one of the best books I have read on scientific writing. Any researcher in mathematics should seek out a copy.

1.15 Statistic on Stanford students from: Consequences of Erudite Vernacular Utilized Irrespective of Necessity: Problems with Using Long Words Needlessly, by Daniel Oppenheimer, available at: http://web.princeton.edu/sites/opplab/papers/Opp%20Consequences%20of%20Erudite%20Vernacular.pdf

Chapter 3

page 33 The statistics on what readers understand on a first reading come from John Adair's "The Effective Communicator" (The Industrial Society, 1989 – also available on Google Books), which I thoroughly recommend to all those offering editing services.

page 34 Clarity in Technical Reporting by S Katzoff (NASA Scientific and Technical Information Division) is freely available at: http://courses.media.mit.edu/2010spring/mas111/NASA-64-sp7010.pdf
More information about this wonderful scientist can be found at: www.nasa.gov/topics/people/features/Sam_Katzoff.html
I would like to thank NASA's Office of Communication for allowing me to quote freely from Katzoff's article both in this and the next chapter.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3, © Springer Science+Business Media, LLC 2011

Dr Coates' abstract to his paper can be found at http://cardiovascres.oxfordjournals.org/content/53/2/279.full
This is vital reading for anyone writing or editing a paper. I would like to thank Dr Coates for giving me permission to quote from his paper and for offering useful advice.
John Kirkman's book (published by E & FN Spon, reprint 2001, also available on Google Books) is essential reading for anyone who revises and edits technical papers. Unfortunately I was unable to contact the author directly.

Chapter 4

page 54 Quotes by John Ruskin are freely available on the web. Bruce Cooper's quote can be found on page 17 of his excellent book (for those offering editing services) Writing Technical Reports (Penguin UK, 1999).

4.1 The full article from The Guardian can be found at: www.guardian.co.uk/books/2010/jul/15/slow-reading

4.8 Leggett A "Notes on the Writing of Scientific English for Japanese Physicists" published in the Nihon Butsuri Gakkaishi (Vol. 21, No. 11, pp. 790–805). This is fascinating stuff for EAP trainers and scientific editors. The full article is available at: http://wwwsoc.nii.ac.jp/jps/jps/topics/Leggett.pdf

Chapter 5

page 74 The first two quotations come from The Penguin Dictionary of Twentieth Century Quotations (1996) edited by M J & J M Cohen. The quote by novelist Barbara Kingsolver comes from a BBC interview with her on June 9, 2010.

Chapter 6

6.6 For more info see: http://www.fact-index.com/u/un/un_security_council_resolution_242.html

6.12 The legal example is based on a real case and is contained in Douglas Walton's paper "New Dialectical Rules For Ambiguity".

6.14 These false friends are reported in Bill Bryson's wonderful book "The Mother Tongue" (HarperCollins).

Chapter 9

page 134 Jacob Bronowski's quote comes from his best-selling book 'The Ascent of Man' first published in 1974 by Little Brown & Co. George Mikes' book is a fun read, you can find the full text at: http://f2.org/humour/howalien.html
The quote from Professor Ken Hyland was commissioned for this book. His article "Writing Without Conviction? Hedging in Science" published in Applied Linguistics (1996) 17 (4): 433–454, is essential reading for all EAP trainers and those offering professional editing services. See: http://applij.oxfordjournals.org/content/17/4/433.short

9.10 For more on this topic, see Dr Maggie Charles's very useful article "Revealing and obscuring the writer's identity: evidence from a corpus of theses" in Chap. 9 of "Language, Culture and Identity in Applied Linguistics", a book by the British Association of Applied Linguistics.

9.13 See reference to 4.8 above.

Chapter 10

page 152 The quotations by Prof Robert Adams and Prof James Hitchmough were specifically commissioned for this book. The quote from Dr. Ronald K. Gratz comes from his paper "Using Another's Words and Ideas". Gratz's paper, which I have also used in 10.3 and 10.5, is essential reading for those in EAP and editing services, it is available at: www.paperpub.com.cn/admin/upload/file/20089394456141.pdf and at http://www.bio.mtu.edu/courses/bl447/persp/fhbk2/plagrism.htm

10.2 Alistair Wood's article was originally published in Science Tribune in April 1997 and is freely available at: http://www.tribunes.com/tribune/art97/wooda.htm. It is a really interesting article and I would like to thank Dr Wood for allowing me to quote extensively from it.

Chapter 11

11.3 For an interesting discussion of this topic see: "When I use a word ... Declarative titles" by Jeff Aronson, available at: http://qjmed.oxfordjournals.org/cgi/content/full/103/3/207

Chapter 12

12.9 Alistair Wood's article was originally published in Science Tribune in April 1997 and is freely available at: http://www.tribunes.com/tribune/art97/wooda.htm

R A J Matthews Tumbling toast, Murphy's Law and the fundamental constants, 1995 Eur. J. Phys. 16 172–176, available at: http://www.iop.org/EJ/journal/EJP

Copyright © 1999 by the American Psychological Association. Reproduced with permission. Kruger, Justin; Dunning, David, Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments, Journal of Personality and Social Psychology. Vol 77(6), Dec 1999, 1121–1134. The use of APA information does not imply endorsement by APA. Full version (great reading!) available online as a pdf.

Chapter 13

13.4 For the full version of Chris Rozek's paper "The Effects of Feedback and Attribution Style on Task Persistence" see: http://gustavus.edu/psychology/files/Rozek.pdf

13.6 Fragmentation of Rods by Cascading Cracks: Why Spaghetti Does Not Break in Half, was published in Physical Review Letters Vol. 95, 095505 (2005). The full version available at: http://prl.aps.org/abstract/PRL/v95/i9/e095505 and http://www.lmm.jussieu.fr/spaghetti/audoly_neukirch_fragmentation.pdf

Chapter 14

14.2 For the full version of Chris Rozek's paper "The Effects of Feedback and Attribution Style on Task Persistence" see: http://gustavus.edu/psychology/files/Rozek.pdf

Chapter 15

15.3 Greg Anderson's biology website from Bates College in Maine, USA is essential reading, even for those researchers outside the field of biology: http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWtoc.html

15.13, 15.14 Morales et al.'s article was published in R13e4v.Adv.Mater.Sci. 21(2009) 134–138 and also by arxiv.org (arxiv.org/abs/0806.1485). It is available at: http://www.ipme.ru/e-journals/RAMS/no_22109/morales.pdf and at http://www.societechimiquedefrance.fr/IMG/pdf/arXiv0806_1485.pdf

Chapter 16

16.4 The quote from Ben Goldacre is from Goldacre B (2008) Bad Science, Harper Collins, London. See also videos on Goldacre's website: www.badscience.net

16.3 Maeve O'Connor, Writing Successfully in Science, HarperCollinsAcademic

16.8, 16.9 Ken Lertzman's "Notes on Writing Papers and Theses" are available for free download at: http://aerg.canberra.edu.au/edulertz.htm

Chapter 17

17.1 Guidelines for medical writing can be found at: www.bmj.com.

17.2 For the full version of Chris Rozek's paper "The Effects of Feedback and Attribution Style on Task Persistence" see: http://gustavus.edu/psychology/files/Rozek.pdf

17.3 See: http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWtoc.html

17.4 Catherine Bertenshaw and Peter Rowlinson's article, "Exploring Stock Managers: Perceptions of the Human-Animal Relationship on Dairy Farms and an Association with Milk Production," appeared in Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals, Volume 22, Number 1, March 2009, pp. 59–69(11), Berg Publishers, an imprint of A&C Black Publishers Ltd.
You can download the full text at:

http://www.ingentaconnect.com/content/berg/anthroz/2009/00000022/00000001/art00006

17.8 "Chickens prefer beautiful humans" originally appeared in Human Nature Volume 13, Number 3, 383–389. A full version is available at: http://www.fao.org/fileadmin/user_upload/animalwelfare/ghirlanda_jansson_enquist2002.pdf

17.10 This subsection was based on Professor Shahn Majid's notes for math students, "Hints for New PhD students on How to Write Papers" which can be found at: http://www.findaphd.com/students/life2.asp

Chapter 18

18.1 The University of Toronto's excellent website on writing skills can be found at:

http://www.engineering.utoronto.ca/Directory/Student_Resources/Engineering_Communication_Program/Online_Handbook/Components_of_Documents.htm

Chapter 19

This chapter owes a lot to all my clients who have provided me with a wealth of phrases over the years, Prof. Antonio Strozzi whose enthusiasm for collecting phrases has resulted in a very useful book (Come Scrivere un Articolo Tecnico in Inglese, Pitagora Editrice, Bologna), and most especially to Dr John Morley and his Phrasebank.

Glasman-Deal's book, "Science Research Writing For Non-Native Speakers of English" (Imperial College Press, 2010), is extremely useful. This is particularly true for those whose research is in subjects such as physics, chemistry, biology and computer sciences. The majority of her examples are extracts from real papers, which she uses to explain a step-by-step structure for each section in a paper. Her philosophy is a template-based approach, involving copying the patterns of other writers. The chapters of her book are designed to be read sequentially and the reader is encouraged to carry out various tasks on the way.

Chapter 20

page 296 The first part of the quotation comes from Lertzman, K.P. 1995. Notes on writing papers and theses. Bulletin of the Ecological Society of America 76:86–90. The quotes from Mark Worden and Sandy Lang were commissioned specifically for this book.

20.4 You can find Dr Coates's paper at: http://cardiovascres.oxfordjournals.org/content/53/2/279.full

20.7 Richard C. Wydick, Plain English for Lawyers (4th ed.). Durham: North Carolina: Carolina Academic Press. 1998:3.

20.9 This quote comes from Ignobel Prizes – The Annals of Improbable Research by Mark Abrahams, published by Penguin Group, USA. I would like to thank him for allowing me to use it.

20.16 There are many agencies that edit and revise scientific documentation. The first agency below is my own and we specialize in revising papers for researchers whose first language is French, Italian, Romanian, Portuguese and Spanish. The other two are agencies that my clients have also used and found to be very professional.
www.englishforacademics.com
(English for Academics, contact: adrian.wallwork@e4ac.com)
www.rescript.co.nz (Rescript, contact: rescript@rescript.co.nz)
www.sfedit.net (San Francisco Edit, US)

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About the Author

Since 1984 Adrian Wallwork has been editing and revising scientific papers, as well as teaching English as a foreign language. In 2000 he began specializing in training PhD students from all over the world in how to write and present their research in English. He is the author of over 20 textbooks for Springer Science+Business Media, Cambridge University Press, Oxford University Press, the BBC, and many other publishers. In 2009 he founded English for Academics (englishforacademics.com), which provides an editing and revision service for researchers (particularly speakers of the following languages: French, Italian, Portuguese, Romanian and Spanish) who wish to publish their work in international journals.

Contact the Author

I would welcome comments on improving this book. I also hold short intensive courses for PhD students and researchers on how to write and present their research.

Please contact me at English for Academics: adrian.wallwork@e4ac.com

Index

This book has been indexed by chapters and subsections (see the index that begins on this page), and by page number (page 323). For more information on grammar use, particularly the use of tenses, see the companion volume English for Research: Usage, Style, and Grammar.

- Numbers in **bold** refer to complete chapters (e.g. **5** = Chapter 5).
- Numbers in grey refer to useful phrases (e.g. key terminology 19.6 = useful phrases regarding how to describe or define your key terms in your paper. This information can be found in subsection 19.6).
- Words in *italics* refer to the usage of specific words (e.g. *although* 3.8 = how the word 'although' should be used in certain contexts. This information can be found in subsection 3.8).
- Words that begin with a capital letter refer to the typical sections in a paper (e.g. Abstracts, Introduction, Acknowledgements).
- Advice about how to use tenses (e.g. present simple, present perfect, past simple) is all contained under TENSES.

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